



Game-based learning in Norwegian classrooms
Perceived challenges and the potential of digital supplementary
resources to facilitate the use of games as teaching tools

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This master's thesis is carried out as part of the education at the University of Agder and is therefore approved as a part of this education. However, this does not imply that the University answers for the methods that are used or the conclusions that are drawn.

University of Agder, 2018
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I Preface

Before you is the master thesis on “Game-based learning in Norwegian classrooms – Perceived challenges and the potential of digital supplementary resources to facilitate the use of games as teaching tools.” The thesis was written to fulfil the graduation requirements of the Master’s programme Multimedia and Educational Technology at the University of Agder, Norway. The research and writing were conducted from January to June 2018.

The project was undertaken based on my interest in games and my experiences as a teacher in Norwegian elementary and lower secondary education. During my work as a newly educated English teacher I tried to implement games as teaching tools in my lessons, with the aim of promoting student motivation and engagement. However, I was faced with multiple challenges. The first challenge was connected to identifying and acquiring suitable games to utilise as teaching tools connected to different learning goals. Other challenges included implementing the games in beneficial ways, the lack of equipment such as headphones and computer mice, and classroom management during game use. I also experienced differing perspectives on the potential usefulness of games from both colleagues and students, where games - digital games particularly – could be seen primarily as entertainment instead of a beneficial teaching and learning tool. As I had problems finding engaging games that I could justify using as teaching tools in classroom contexts, I decided to develop my own game. This led to the development of the board game Words of Power, which is used as a resource in this master’s project. For my project I wished to continue exploring game-based learning and gain insight into other teachers’ experiences with the use of games as teaching tools. Additionally, I wished to participate in providing information and resources that can be useful in the facilitation of game-based learning in Norwegian schools, which is why the study has an added focus on the positive potential of digital supplementary resources.

I would like to extend my thanks to my supervisors, Rune Andersen and Christian Simonsen, for their guidance during the project. I also wish to thank the teachers and students who participated in the research. Thank you also to my friends and my significant other who have supported me in my endeavours. Additionally, I want to thank my parents for their support of my interest in games, and for their early understanding that some games cannot be paused.

I hope you enjoy the read.

Marielle Juveng

Grimstad, May 30, 2018

II Summary

Games are a popular form of entertainment that can keep individuals motivated and engaged for hours at a time. Our motivations to sink multiple hours into playing games have been studied by researchers, instructional designers, and game designers alike, with the goal of understanding and highlighting the elements that have positive or negative effects on the players. Games have also been recognised as a potential teaching and learning tool due to their capability to integrate content and elements that nurture intrinsic motivation, learner engagement, and facilitate different approaches to learning. However, due to a scarcity of research on the use of both analogue and digital games in Norwegian education, it is challenging to discern how frequently Norwegian teachers utilise games as teaching tools. The purpose of this study is to provide insight on teachers' use, or lack thereof, of game-based learning in Norwegian elementary, lower secondary, and upper secondary education. The study focuses on exploring what makes games beneficial teaching tools, the perceived challenges that hinder the adoption of games, and the potential of digital supplementary resources to facilitate the use of games as teaching tools in classroom contexts.

The study is based on existing theory on motivation, pedagogy, and the facilitation of tools in education, in addition to data collected from Norwegian teachers using a mixed methods approach. The data gathering was conducted in two stages. The first stage utilised a parallel gathering approach, where data was gathered in the same time span through an online questionnaire and through semi-structured interviews. The aim of the research in stage one was to gather information about teachers' use and beliefs about games as teaching tools, the perceived challenges of using games in classroom contexts, and the potential usefulness of various digital supplementary resources that can assist teachers in using games as teaching tools. The objective of the research in stage two of the study was to evaluate the practical potential of different digital resources to facilitate the use of games as teaching tools in classroom contexts. Four digital resources connected to a self-designed educational board game were developed, based on the data gathered in stage one of the research. A class set of the board game, together with the developed digital supplementary resources, were provided to two teachers in separate classes, who implemented the game in their English lessons. The lessons were observed, and the teachers were interviewed afterwards.

The results reveal that games are to some degree viewed to be beneficial teaching tools by teachers, and that games of different types are utilised in Norwegian classrooms. However, the results suggest that many teachers have limited knowledge connected to the content and elements in games that form beneficial learning environments. According to theories on motivation, games can promote intrinsic motivation and learner engagement due to the integration of content and elements that satisfy the players' intrinsic psychological needs for autonomy, competence, and relatedness, while offering opportunities to satisfy individual motivations for play (Rigby & Ryan, 2011; Yee, 2005a). Also, games have the capability to facilitate different student-centred approaches to learning, and to integrate content, feedback, and scaffolding systems that when combined promote learner engagement and performance. The results of the research reveal that there are multiple perceived challenges that hinder the

adoption of games as teaching tools. A lack of knowledge and skill connected to games as teaching tools is perceived to hinder teachers in identifying and implementing games that are beneficial to use in classroom contexts. Other perceived challenges that hinder teachers include time restrictions, both inside and outside of the classroom, school equipment and economy, classroom management during game use, as well as the beliefs and expectations of colleagues and students. The results indicate that games are used more frequently in classroom contexts with younger students, primarily due to fewer requirements connected to the game content. Games are also more likely to be implemented as teaching tools if they are perceived as easy to access, learn, and to use in lessons. The results show that digital supplementary resources, such as videos and websites containing information, can assist teachers in acquiring knowledge about games as teaching tools, help them acquire and learn new games, and provide recommendations for beneficial classroom implementation. Teachers can also utilise digital resources as a supportive tool during lessons. Additionally, the results reveal that access to resources can aid teachers in developing confidence in their own abilities and teaching methods. These findings align with existing theory on professional development (Ertmer & Ottenbreit-Leftwich, 2010; Lawless & Pellegrino, 2007), and support that access to digital supplementary resources can facilitate the use of games as teaching tools in Norwegian classrooms.

Due to constraints in the study, future research should seek to investigate the long-term effects of access to supplementary resources on game-based learning in Norwegian classrooms, and whether the findings of this study converge with the use of games and the perceived challenges in higher education. An interesting avenue for future research could focus on students' perspective regarding the use of game-based learning in classrooms, to see if their perceptions align with the perspectives of teachers. It would also be beneficial to conduct research to evaluate the availability of suitable educational games connected to specific subjects or curriculum goals. The findings, alongside the results from this study, have the potential to assist game designers and publishers who want to expand into the education sector to create games and supplementary resources targeting areas of need, which can further facilitate the use of game-based learning in Norwegian classrooms.

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1 Introduction

1.1 Background

Playing games is a popular and widespread form of leisure. The access to and use of games has particularly expanded due to the rise of the digital game industry, enabling individuals of all ages to acquire and explore new games from the comfort of their own homes. In Norway it is estimated that 96% of boys and 76% of girls between the ages of 9 - 16 play digital games in their spare time (Medietilsynet, 2016). Games are most commonly regarded as a form of entertainment that is capable of pulling the users into the game world and keeping them engaged for hours at a time. Our motivations to sink multiple hours into playing games have been studied by researchers, instructional designers, and game designers alike, with the goal of understanding and highlighting the elements that have positive or negative effects on the players. In the last decades, academia, government, and corporations have started recognising the positive motivational and educational potential of games. This realisation of potential has led to the creation of games intended for educational purposes (Ritterfeld, Cody & Vorderer, 2009), as well as non-game products and activities that utilise game elements to promote motivation (Deterding, Dixon, Khaled & Nacke, 2011).

The potential educational benefits of games as teaching and learning tools have been recognised in the Norwegian parliament (St.meld. Nr. 22, 2011). However, due to a scarcity of research on the use of games in Norwegian education, it is challenging to discern how frequently games are utilised as teaching tools, as well as which types of games are integrated and for which purpose. Knowledge of game usage and the potential effects in Norwegian classrooms has become more prevalent in the recent years through different research projects (Nordby & Knain, 2014; Sigurðardóttir, 2016) and master theses (Andreassen, 2015; Augedal & Singstad, 2001; Furlund, 2014; Skog, 2015; Tisthammer, 2014; Østby, 2016). Yet there are still few studies that seek to explore the use, or lack thereof, of both analogue and digital games in Norwegian education.

1.2 Introduction to games

When looking up the word “game” in dictionaries, there are various results and many of them are not connected to what this thesis is about at all. When individuals talk about games, there can be many different expectations and views on what games are. Multiple definitions have been created by academics and game designers, yet there is not a universally accepted definition. Game designers Salen & Zimmerman (2004, p. 96) define a game as “[...] a system in which players engage in an artificial conflict, defined by rules, that results in a quantifiable outcome”, whereas McGonigal (2011, p. 21) suggests that “[...] all games share four defining traits: a goal, rules, a feedback system, and voluntary participation”. Both definitions include the importance of a system with defined rules and quantifiable outcomes or feedback, while the latter definition additionally highlights the importance of the activity being voluntary to participate in. Huizinga (1949), in his book about play, offers definitions

of what “play” is, which are also applicable to what games can be defined as. He describes six characteristics of play: (1) play is voluntary; (2) to play is to pretend: it exists outside of ordinary life; (3) play is immersive; (4) it is played out within limitations of time and place; (5) play is based on rules; (6) and play is social, enabling the players to identify themselves as a group. Based on these definitions, games can be seen as a structured form of play which individuals willingly engage in, where they receive feedback on their actions in their pursuit of specific goals.

Games come in various types. The type of the game indicates the game’s medium, for example whether the game is played with dice, cards, a board, or a computer. This thesis additionally uses the definitions analogue games and digital games. Analogue games are here considered as all games that are not played digitally. This includes board games, dice games, card games, communication games, and more. Digital games refer to all games played digitally, which include games played on computers, tablets, phones, and different consoles. In addition to there being multiple types of games, there is a myriad of game genres, such as action games, role-playing games, strategy games, sports games, and adventure games. All games consist of something called gameplay, which is defined as the “[...] interaction that occurs when players follow the rules of a game and experience its system through play” (Salen & Zimmerman, 2004, p. 3). Gameplay is viewed to be formed through game components which reward, immerse, and challenge the players, compelling them to continue the activity (Oxland, 2004). Games of different types and genres will therefore provide the players with different kinds of gameplay.

Games are multimodal, featuring numerous resources used to communicate the content and meanings to players (Gee, 2007). Digital games especially have the capability to integrate multiple modalities, such as text, images, animations, sounds, and haptics. Through the inclusion of multimodality, games promote the development of multiliteracy in the players, which is the ability to understand and use diverse modes of communication (Gee, 2007). Games as a medium are through the inclusion of different game elements capable of nurturing sustained engagement, motivation, and persistency in the players, leading educators and instructional designers to seek their use as an instructional method in education (Fletcher & Wind, 2014).

1.2.1 Game-based learning

The method of using games as a teaching and learning tool is called game-based learning. Game-based learning can be viewed as learning through play, where the learners participate in games and gameplay that have defined learning outcomes (De Freitas, 2006). While playing games, the learners are active participants in the learning process, where their choices and actions within the game yield immediate consequences and feedback (Bloom, 2009). Game-based learning emphasises the importance of balancing both entertaining gameplay and educational subject matter content, to create engaging and educational learning experiences (Kiili, 2005). Game-based learning is commonly exploratory and experience-based in nature, and therefore depends on game content and gameplay which can promote

experiential or exploratory learning approaches (De Freitas, 2006). The game-based approach to learning does however not solely rely on the content and gameplay of the games to be effective; the teacher plays an important role in assisting the students' learning process by facilitating reflectional activities and the transfer of learning to non-game contexts (De Freitas & Oliver, 2006).

Game-based learning can be integrated into the classroom in different ways. Teachers can utilise commercial off-the-shelf (COTS) games, which are games typically designed to be entertaining and engaging, by placing focus on specific parts of the game or the gameplay that have connections to the subject (Van Eck, 2006). There are countless of COTS games to choose from, however as these games are not designed to teach, the educational content can be limited or inaccurate (Van Eck, 2006). Teachers can also seek out and use games that are primarily designed for educational purposes. Games designed with the educational content as focus are more likely to contain content which align well with lesson plans and goals; However, these games risk being less motivating and engaging to play than their commercial counterparts, due to a reduced focus on interesting and engaging gameplay (Doucet & Srinivasan, 2010). Educational games with a primary focus on learning, often deemed as more 'serious' games due to the reduced focus on entertainment, have become increasingly popular to use for training and educational purposes (Micheal & Chen, 2006).

1.2.2 Serious games

Serious games can be defined as “games used for purposes other than mere entertainment” (Susi, Johannesson & Backlund, 2007, p. 1), while other definitions highlight that education and the acquisition of specific knowledge and skills remain the primary goal (Micheal & Chen, 2006). Zyda (2005) argues that it is the addition of pedagogy in games that makes games serious, as the games are then more than just story, art, software and hardware. Serious games also tend to put a larger emphasis on problem solving and natural communication than entertainment games (Susi et al., 2007). While communication in entertainment games is often perfect, serious games seek to reflect natural and non-perfect communication to provide situations closer to 'real' life. Games allow players to explore situations that are challenging or normally impossible to experience in the real world due to reasons connected to safety, cost, time, or logistic (Corti, 2006). Games also provide players with safe environments designed for learning, which minimizes the negative impact of failure (Squire & Jenkins, 2003). Serious games are therefore often used as training tools in sectors where the activities and tasks have impactful consequences, such as in the military and health care (Squire & Jenkins, 2003; Zyda, 2005). Serious games typically leverage technology to create digital and virtual learning environments used for instruction and training.

1.2.3 The impact of technology on gaming

Games have always played a part in human society, where one of the first games discovered, called Royal Game of Ur, can be traced back to ca. 3000 BC (Glimne, 2017). While games have always been a popular form of leisure, the game industry has seen an exponential growth in the past decades with the advent of more advanced technology (Rogers, 2016). Individuals now have access to personal computers, smartphones, and consoles on which they can play games with others all over the world, both synchronously and asynchronously. Modern technology enables games to integrate multiple modalities and provide real-time performance feedback to the players (Gee, 2006). Digital games also have the capability of integrating systems which provide formative assessment to the players, while enabling and assisting teachers in monitoring and evaluating the individual students' progress in the game (Shute, Ventura, Bauer & Zapata-Rivera, 2009). Formative assessment can be viewed as feedback on performance that is given during the learning process, which serves to guide or modify the teaching and learning to improve student achievement (Heritage, 2007). Through technology, teachers can acquire real-time results on student performance, which can be utilised to modify the content in upcoming lessons to better fit the needs of individual students or student groups (Shute et al., 2009). Game developers also have the possibility to implement dynamic game balancing (DGB), which are systems that enable the game content to adapt based on the player's abilities (Andrade, Ramalho, Santana & Corruble, 2005). DGB can be used to dynamically regulate challenges to avoid making the players bored or frustrated due to wrong difficulty levels (Andrade et al., 2005). Games that utilise DGB can therefore enable differentiated learning, in which the learners are provided content and challenges appropriate for their current knowledge and skills.

The technology artificial intelligence (AI) is commonly used in digital games to adjust game balancing systems and to control non-playable characters (NPCs) and their interactions with players (Treanor et al., 2015). The technology has been in development for decades and is continuously progressing into new use areas. AI can be defined as intelligence demonstrated by machines, where the machine 'agents' receive percepts from the environment and perform actions to achieve specified goals (Russel & Norvig, 2016). With progressing AI technology, game developers have the capability to integrate more sophisticated AI which can learn from interacting with players, co-create content with players, prove to be challenging in-game opponents, enact simulations, and directly guide and support the players in the game world (Treanor et al., 2015). The use of sophisticated AI in games can therefore further assist the players in their interactions with the content in the game world, and provide individual players with new and adaptive experiences tailored to their interests and skills. Adding to this, the use of virtual reality (VR) technology can be utilised to create games with immersive 3D environments, in which the players can explore new situations and practice different skillsets in lifelike but safe learning environments (Fowler, 2015).

1.3 Existing research on the educational use of games

Sigurðardóttir's (2016) empirical study on the use of digital game-based learning is one of the recent and more expansive studies conducted on the topic in Norway. The study highlights that game-based learning is seen as a controversial teaching method compared to other approaches, primarily due to the close connection between digital games and entertainment. Sigurðardóttir (2016) found that the acceptance and use of game-based learning in education is affected by the media's portrayal of games, and that the teachers' own views and expectations of games contribute to the use of games as teaching tools in classrooms. The Norwegian Centre for ICT in education and the Norwegian game pedagogues Husøy and Staaby have evaluated the potential usefulness of digital games in classroom education, provided suggestions for beneficial use, and suggested potential barriers that can hinder the implementation of game-based learning in schools (Skaug, Staaby & Husøy, 2017). They view games as potential and valuable educational tools due to their capacity for offering learners a combination of entertainment, excitement, reflection, and diverse challenges and tasks that need to be solved (Skaug et al., 2007). Skaug et al. (2007) additionally highlight that it is important that the participants in game-based learning are aware that games are primarily a tool and should not be the core source of knowledge for the learners. Teachers still have critical roles in the classroom while using games as teaching tools, as they need to assist the students' knowledge construction by facilitating discussions and reflectional activities that connect the game content to "real life" contexts (Skaug et al., 2007).

A 2014 survey commissioned by Games and Learning Publishing Council, consisting of close to 700 respondents in the US, indicates that digital games are becoming a regular tool in classrooms (Takeuchi & Vaala, 2014). The study revealed that a large percentage of teachers choose to utilise digital games in classroom education on a weekly or monthly basis, and that teachers are learning to utilise game-based learning primarily through informal means as opposed to through formal training programs (Takeuchi & Vaala, 2014). The study additionally showed that teachers were more likely to select games to use in lessons based on word of mouth from others in the profession, the features in the game (assessment and classroom management features), their experience with or preference for the game, followed by research evidence of the game's educational impact (Takeuchi & Vaala, 2014). It is however important to note that while there are many studies on the use of digital games in education, there is little research also including the use of analogue games. The use of games in education may therefore be more common than indicated by existing studies when also accounting for analogue games usage.

The potential effects of games have been studied from multiple angles, including positive and negative effects on youth development. There is decades of research on video games' impact on aggressive behaviour development, resulting in varying conclusions (Andersen, 2004; Griffiths, 1999; Markey, Markey & French, 2015; Sherry, 2001; Strasburger, Donnerstein & Bushman, 2014). The topic of video games and the potential connection to real-life aggression and violence has had widespread coverage in media, particularly after instances of mass shootings both in the US and in Norway (Campbell, 2018; Disis, 2018; Ringgaard,

2013; Sandli, Meldalen & Thømt Ruud; 2011). Another concern is connected to game addiction and lower academic performance. There are concerns that games can create addictive habits and negatively impact academic performance (Grüsser, Thalemann & Griffiths, 2006), but many studies indicate little or no direct connection between game use and lower academic performance (Creasey & Myers, 1986; Schie & Wiegman, 1997; Skoric, Teo & Neo, 2009). The potential addictiveness of games is viewed to more likely stem from individual personality factors (Mehroof & Griffiths, 2010) and the players' motivations for play, e.g. to escape other things in life (Griffiths, 2010). There is also a growing amount of research on the positive effects of games, including the motivational and educational benefits that games can offer (De Freitas, 2018; Gee, 2007; Granic, Lobel & Engels, 2014; Griffiths, 2002; McGonigal, 2011; Rigby & Ryan, 2011; Whitton, 2011).

Research shows that games are capable of getting players highly engaged in complex content and situations, where the game content and gameplay can motivate them to continue spending time on activities in the game and related to the game (Dickey 2007; Przybylski, Rigby & Ryan, 2010). Games are viewed to be engaging and motivating to play as specific game elements and content provide the players with meaningful choices, appropriate challenges, and the feeling of control, as well as the possibility to connect with others (Przybylski et al., 2010; Rigby & Ryan, 2011). The game-based approach to learning is demonstrated to be more motivational than non-gaming approaches (Papastergiou, 2009). The motivational and engaging forces of games can therefore be utilised to achieve desired learning outcomes in classroom contexts (Garris, Ahlers & Driskell, 2002). Games have varying educational potential depending on their type, genre, integrated elements and content (Dickey, 2005), in addition to the context in which they are being played (de Freitas & Oliver, 2006). Games have the potential to offer many positive benefits connected to skill development. Skaug et al. (2017) highlight that games can be used to teach skills defined as critical to develop by the Norwegian Directorate for Education and Training, such as digital skills (e.g. use, modify, and create digital resources) and basic competencies (reading, writing, Mathematics, and oral skills). Different research shows that playing games can improve cognitive skills such as fine motor control, eye-hand coordination (Griffith, Voloschin, Gibb & Bailey, 1983), information processing skills (Yuji, 1996), spatial visualization ability (De Lisi & Wolford, 2002), as well as the ability to multitask (Cardoso-Leite, Green & Bavelier, 2015).

Games can also promote deep learning processes and assist players in developing skills which are deemed important to master in the 21st century (Gee, 2009; San Chee, 2013; Spires, 2008; Qian & Clark, 2016). Gee (2009) argues that “games are, at their heart, problem-solving spaces that use continual learning, and provide pathways to mastery through entertainment and pleasure”, where the content in games can promote both surface learning and deep learning. Certain games, such as Trivial Pursuit, contain content which promotes surface learning through requiring the players to be able to memorize and repeat or reproduce information and knowledge (Gee, 2009). Other types of games contain content which require the players to be creative and to use their problem-solving and communication skills to form different strategies and solutions (Gee, 2009). Gee (2009) argues that individuals cannot learn in deep ways if they are not willing to be committed to learning in terms of time, effort and

active engagement, and that games can therefore be excellent tools for learning as they promote active engagement and the willingness to spend time and effort on the in-game activities.

Van Eck (2006) highlights that the effectiveness of using games as teaching tools is partly due to the learning taking place in what are perceived as meaningful and relevant contexts within the game. What the players learn in the game has direct connections to the environment they are in, where the players are able to demonstrate knowledge and skills which are relevant to the situation and gain immediate feedback based on their performance (Van Eck, 2006). Games can therefore be seen as beneficial learning environments, where the contextual challenges in the game enable the development of situated knowledge and skills (Shaffer et al., 2005). However, a study by Sandford, Ulicsak, Facer & Rudd (2006) on the use of COTS games in formal education reveals that the teacher's experiences, teaching style, and familiarity with the curriculum are the primary factors for whether games are successfully integrated as teaching tools in the classroom. They also found that the teacher's teaching and scaffolding skills, in addition to personal game experience, impact the potential educational value of game-based learning (Sandford et al., 2006). De Freitas' (2006) review of game-based learning indicates that one of the key obstructions to utilizing games as teaching tools in education is a lack of empirical data supporting the learning effectiveness of games, as well as teachers' lack of understanding about how to effectively use games in educational contexts. De Freitas (2006) additionally highlights that another barrier to using games is the schools' reported lack of access to up-to-date equipment which can efficiently run modern digital games. The study by Sanford et al. (2006) revealed various challenges of using games in a school context. Their key findings suggest that technical issues can be commonplace, the fixed length of lessons can be constraining regarding planning and implementation of game use, and that the students' expectations, attitudes and expertise connected to games can impact the use of games as teaching tools both positively and negatively (Sandford et al., 2006). Sandford et al. also suggested that the technical infrastructure of the school, school culture and traditions, as well as the individual teachers' personal experience with games and their identities as teachers significantly influence the use, or lack of use, of games in education. Skaug et al. (2017) also portray technical challenges as a large barrier of using digital games in education, but they note that technical challenges come in multiple forms. Technical challenges can consist of acquiring games and licenses, the installation of games, hardware restrictions, or the economy of distributing games to a whole class of students (Skaug et al., 2017). The 2014 survey by Games and Learning Publishing Council revealed that teachers find time and cost to be the greatest barriers to using digital games in the classroom (Takeuchi & Vaala, 2014). Other major barriers revealed in the survey include the lack of technical resources, the difficulty of finding games that fit the curriculum, not knowing where to look to find quality games, and the increased emphasis on standardized test scores (Takeuchi & Vaala, 2014). The practical integration of games in education was also perceived as a challenge, as many educators revealed feeling uncertain on how to use games as a teaching method (Takeuchi & Vaala, 2014).

1.4 Developed resources

This section describes resources that have been developed by the researcher and used in the data gathering and evaluation of game-based learning in education. Prior to this thesis, the researcher designed and developed a cooperative board game named Words of Power. This board game was utilised in the study, together with digital resources connected to the game, to evaluate teachers' willingness or desire to use games as teaching tools when they have access to digital supplementary game resources. Six copies of the game were created for classroom use, enabling a class consisting of 26 students to be able to form groups composed of 4 – 5 players.

1.4.1 Words of Power

The board game Words of Power is designed to be appropriate for use in English lessons with students between the ages of 10 – 14. The game features educational content which promotes the players to practice their English spelling, communication, and teamwork skills. The game can be played in groups of 2 – 6 players, where the goal of the game is to cooperate to find the exit to the maze the players find themselves in. In order to find the exit, the players need to form and explore the game board by placing down new maze paths, while using their English spelling skills to defeat obstacles and monsters that show up in their paths. The educational content and gameplay were designed to provide the players with three different difficulty levels. The individual players are able to select the desired difficulty level of each challenge they face, enabling them to attempt challenges that fit their skill level in English spelling. The English vocabulary in the game was retrieved from local lesson plans ranging from 6th grade to 8th grade in the Norwegian school system. The game is also designed with the aim of being experienced as fun and engaging to play, by incorporating game rules and mechanics which enable the players to make choices that affect the situation on the game board, overcome challenges of different difficulties, and gain rewards and feedback based on player performance. The game also provides variation through the cards that are drawn during challenges and the player placement of the maze paths, to make each play session different from the last. The design of the game rules and mechanics were built on game design theory by game designers Koster (2013) and Salen & Zimmerman (2004), as well as on motivation theory by Deci & Ryan (2008) and Rigby & Ryan (2011).

The design and development process of the game was based on iterative game design, where the game was played with early prototypes and further developed based on play test results (Salen & Zimmerman, 2004). The game was tested during development with 23 Norwegian pupils as participants. The age of the participants ranged from 10 – 16 years old. The participants reported that the game was perceived as engaging to play, had compelling visual design, and that the most enjoyable action in the game was defeating monsters, which is the activity that requires the players to use their English spelling skills.

1.4.2 Digital supplementary resources

Four different digital resources were developed for the self-made board game Words of Power. The resources consist of (1) written information about the game's design and how the content and gameplay can promote motivated behaviour and learning, (2) a video and written information regarding how to prepare the game for play (set up the board etc.), (3) a video and written information explaining how to play the game, and (4) written suggestions on how to effectively integrate the game in classroom lessons. The resources were hosted on a website (see Appendix A), which was made with the intention of being provided to participants in the research. The game resources were developed during the study based on teachers' opinions on the usefulness of specific digital resources connected to the planning and integration of game-based learning in classrooms. The methods for data gathering are explained in chapter 3.

1.5 Hypothesis and research questions

The study seeks to provide insight on the use of games in Norwegian elementary education, lower secondary education and upper secondary education¹, in addition to highlighting potential challenges that hinder the adoption of games as teaching tools. The study also aims to explore the potential impact of digital supplementary resources on the integration of games as teaching tools in Norwegian education. The hypothesis of the research is that *a better understanding of the educational potential of games and access to digital supplementary resources will lead to a higher integration of games as teaching tools in Norwegian Education*. The hypothesis is based on theory that games can create environments that foster intrinsic motivation, sustained engagement, and facilitate different approaches to learning. It is believed that games are not utilised to their full potential in Norwegian education due to being perceived as entertainment, challenging to incorporate into lesson plans, and time-consuming to acquire, learn and use. Furthermore, the hypothesis is based on the belief that easy access to supplementary resources, including how-to-play videos, suggestions for integration, and information about the learning potential of the game, will facilitate the use of games as teaching tools in education. The study therefore seeks to answer the three following research questions:

1. What makes games beneficial teaching tools, and what is the perceived state of knowledge of teachers on this topic?
2. What perceived challenges hinder the adoption of games as a teaching tool?
3. Does access to digital supplementary resources facilitate the use of games as teaching tools?

The data gathering in the study was conducted in two different stages. The aim of the first stage of the data gathering was to collect data on teachers' knowledge and beliefs connected to games, their use of games in classroom contexts, the perceived challenges of utilising

¹ The Norwegian school system is made up of elementary school (Barneskole, ages 6 - 13), lower secondary school (Ungdomsskole, ages 13 - 16), and upper secondary school (Videregående skole, ages 16 - 19).

games, as well as the potential usefulness of digital resources connected to games. A part of the data gathered in this stage was used to make decisions on which digital resources were to be developed for the self-made board game Words of Power. The game and the developed resources were in stage two implemented in classroom contexts, where the primary goal was to evaluate whether access to the developed game resources were experienced as useful and could increase the teachers' willingness or desire to utilise games as teaching tools.

1.6 Limitations and challenges

In a study regarding the use of games as teaching tools and the impact of challenges and supplementary resources on game integration, it would be beneficial to analyse teachers' use of games over a longer period of time to better evaluate the long-term effects of easy access to digital supplementary resources. However, as the study was conducted in a subject consisting of 30 ECTS and a time limit of one semester, it was not feasible to gather data over a longer period of time or with a larger sample size. The sample size in stage one of the data gathering consisted of 64 respondents, distributed over two data gathering methods. This sample size is deemed as large enough for the purpose of acquiring data about teachers' attitudes, use of games, perceived challenges and the potential usefulness of digital resources. However, the evaluation and practical implementation of the board game and the accompanying resources in stage two of the data gathering had a sample size of 2 participants. The low sample size was chosen due to time and resource limitations, but for future research the sample size should be larger in order to increase the reliability and validity of the results on the impact of digital supplementary resources connected to game-based learning.

The study was limited to elementary school, lower secondary school and upper secondary school in Norway, as these grade levels cover common core subjects and therefore have more in common than different fields of studies found in higher education. It should therefore be noted that the findings are not representative of the use of games and the potential challenges connected to game-based learning in higher education in Norway. There were also limitations connected to the development of the digital supplementary resources due to time restrictions. The development period was set to two weeks to allocate enough time to gather data and analyse the data from both research stages. Therefore, certain proposed digital resources were not developed for the study as it would not be feasible within the allotted time.

2 Theory

This chapter explores theory connected to motivation, learning theories, and factors influencing the integration of innovative tools in schools. Motivation theory is important for teachers and game designers alike, as their goal is to create motivating and engaging environments (Dickey, 2005). Motivation is therefore an important area in this study, as games of different types and genres can be utilised in classrooms to promote student motivation and engagement. Different theories connected to learning are also examined. The selected theories offer perspectives and approaches to effective learning, updated for our modern and digital society. Learning theories are important to explore as various teaching tools can facilitate different approaches to student learning. How games as a tool can facilitate learning is discussed in chapter 4. Lastly, factors that influence the integration of new tools in schools are noted upon. These factors are important to be aware of, to better understand how to facilitate the use of games as teaching tools in classroom contexts.

2.1 Motivation

Motivation concerns individuals' needs, desires and actions, and is regarded as a fundamental part of human behaviour (Ryan & Deci, 2000). Motivation is viewed to have a direct impact on learning and productivity, which makes it crucial for individuals whose roles are responsible for mobilizing others to perform to have knowledge on how to foster motivating learning environments (Dickey, 2005). Motivation has been researched for decades, resulting in multiple psychological theories that aim to explain human behaviour and motivation (Bandura, 1986; Deci, 1971; Deci & Ryan, 2008; Malone & Lepper, 1987; Maslow, 1943; Skinner, 1963). Early motivation theories stressed the importance of rewards and punishment in order to motivate individuals to perform specific actions (Steers, Mowday & Shapiro, 2004). However, recent and more sophisticated theories posit that learning and work can be inherently interesting and enjoyable, where the presence of external factors such as rewards and punishment can undermine interest, performance, and productivity (Deci, 1971; Ryan & Deci, 2000).

2.1.1 Intrinsic and extrinsic motivation

Recent motivation theories propose that human motivation is affected by intrinsic and extrinsic motives, enabling individuals to be intrinsically or extrinsically motivated to perform specific actions (Deci, 1971; Ryan & Deci, 2000). Intrinsic motivation is defined as “[...] the inherent tendency to seek out novelty and challenges, to extend and exercise one’s capabilities, to explore, and to learn” (Ryan & Deci, 2000, pp. 70). Intrinsic motivation can also be considered as the innate satisfaction gained by performing actions of interest (Ryan, Rigby & Przybylski, 2006). Extrinsic motivation is on the other hand connected to external factors such as rewards, punishment, the absence of punishment, seeking approval from others, or by avoiding shame and the diminishment of one’s own ego (Deci & Ryan, 2008). While both intrinsic and extrinsic motivated behaviour lead to productivity, individuals

whose actions are intrinsically motivated tend to show more effective performance, persistence, creativity, self-esteem, and well-being than those who are motivated by extrinsic factors (Ryan & Deci, 2000). Extrinsically motivated behaviour may over time negatively impact individuals' well-being, interest, and productivity, as they can feel pressured to behave, think or feel in specific ways (Deci, 1971; Deci & Ryan, 2008). It is therefore important that individuals who are responsible for creating beneficial learning environments strive to promote intrinsically motivated behaviour (Ryan & Deci, 2000).

2.1.2 Self-determination theory

Deci & Ryan (2008) have expanded on their work on intrinsic and extrinsic motivation to create a macro theory of human motivation and behaviour called the self-determination theory (SDT). SDT has been applied to research in many fields, including education and game psychology (Niemic & Ryan, 2009; Przybylski et al, 2010; Rigby & Ryan, 2011). The self-determination theory (SDT) posits that human motivation and behaviour are affected by intrinsic and extrinsic factors, in addition to three universal psychological needs (Ryan & Deci, 2008). These innate needs consist of the need for autonomy, competence and relatedness (Ryan & Deci, 2008). The psychological need for autonomy is defined as “[...] our innate desire to take actions out of personal volition” (Rigby & Ryan, 2011, pp. 10). Competence concerns our experience of overcoming challenges and our innate desire to develop our abilities, while relatedness concerns our innate desire “[...] to have meaningful connections to others” (Rigby & Ryan, 2011, pp. 10). These psychological needs are critical to satisfy in order to promote intrinsic motivation, long-lasting engagement, optimal functioning, and well-being (Deci & Ryan, 2008).

2.1.3 Player Experience of Needs Satisfaction theory

SDT has served as the foundation in the creation of the Player Experience of Needs Satisfaction theory (PENS), which is a theory that seeks to explain the motivational pull of games (Rigby & Ryan, 2011). PENS asserts that games include different elements that excel in satisfying the innate needs for autonomy, competence and relatedness (Przybylski et al., 2010; Rigby & Ryan, 2011; Ryan, Rigby & Przybylski, 2006). Games that offer situations and choices perceived as interesting or meaningful satisfy the need for autonomy, which is important for long-term engagement and our intrinsic motivation to continue participating in the game activities (Przybylski et al., 2010; Rigby & Ryan, 2011). According to Rigby & Ryan (2011), games can nurture the intrinsic need for autonomy in many ways. The need for autonomy can be satisfied through the opportunity for players to shape their in-game identity and actions, to create different strategies or solutions used to overcome challenges, or by being provided the freedom to explore the game environment at their own pace or based on their own interests (Rigby & Ryan, 2011).

PENS proposes that individuals enjoy playing games because certain elements can instil a sense of relatedness - the feeling that we as individuals matter - either to other players or to the characters and events in the game world (Rigby & Ryan, 2011). Games can satisfy the

need for relatedness by enabling players to communicate with each other, and to cooperate and collaborate in overcoming challenges. Single player games also have the capability to satisfy the need for relatedness by incorporating compelling characters and events that react in realistic ways to the players' identity and choices in the game world (Rigby & Ryan, 2011). The need for competence can be satisfied when games provide players with performance feedback on their actions, activities and tasks that challenge them at their current skill level, and by promoting competition, either against the game itself or other players (Rigby & Ryan, 2011). These competence elements enable players to develop their abilities and achieve a feeling of mastery and control, in addition to providing a short-term increase in psychological well-being (Rigby & Ryan, 2011). The story in games can also instil a feeling of mastery and control as it can portray the player as a hero, someone of exceptional ability and great worth. By utilizing storytelling methods, games can show direct support for the players by believing in their abilities, which is of importance for the players' mastery potential and growth (Rigby & Ryan, 2011). However, in order for the game content to be able to satisfy players' need for competence, the players need to be able to master the game's controls (Rigby & Ryan, 2011). Rigby & Ryan (2011) call this control mastery, which concerns the players' capability and skill development to translate their intentions into the desired actions within the game. When players feel incompetent at the game's controls, they will not be able to feel confident and competent playing the game content either. Control mastery is therefore seen "[...] as a gateway to enjoyment and motivation in games" (Rigby & Ryan, 2011, pp. 35).

2.1.4 Performance feedback in games

Games have the capability to integrate what Rigby & Ryan (2011) call competence feedback mechanisms. Competence feedback mechanisms are game elements that communicate information to the player about his or her in-game situation and performances. The purpose of these performance feedback mechanisms is to recognise the players' abilities and to promote their feeling of competence (Rigby & Ryan, 2011). The feedback mechanisms are sorted into three categories, named granular feedback, sustained feedback and cumulative feedback (Rigby & Ryan, 2011).

Granular feedback mechanisms are immediate cues that have a one-to-one relationship with each of the player's individual actions (Rigby & Ryan, 2011). Granular feedback mechanisms can take many visual and auditory forms, and are used to recognise the player's moment-to-moment success (Rigby & Ryan, 2011). In a digital platformer game, the granular feedback can consist of visuals and sounds connected to the in-game character jumping and moving as response to player actions, or the visual loss of health upon attacking or being attacked. Whereas in a digital driving game, the granular feedback can consist of smoke, rumbles, car sounds, and on-screen visual information about speed and location (Rigby & Ryan, 2011). While granular feedback mechanisms provide moment-to-moment feedback, sustained feedback mechanisms track sustained success and failure rates, and provide the players with feedback on their performance consistency and the progression of their skills (Rigby & Ryan, 2011). Sustained competence feedback mechanisms include score bonuses, track records,

sustained visual and auditory cues, and temporary rewards or power-ups based on player performance (Rigby & Ryan, 2011). Lastly, cumulative competence feedback mechanisms provide permanent progression and lasting recognition of the player’s skills, which do not disappear after the game session has ended (Rigby & Ryan, 2011). These mechanisms include total scores such as win-loss records and leaderboards, achievement badges, increases in character abilities and reputation, the acquisition of new items or abilities, and the unlocking of new game areas or levels.

2.1.5 Individual motivations for play

Researchers argue that individuals have different motivations for doing specific actions, such as playing games. Rigby & Ryan (2011) highlight that many individuals play games because certain game content is experienced as inherently interesting and enjoyable due to the satisfaction of intrinsic needs, while other researchers argue that some individuals’ primary reason for playing games is escapism (Griffiths, 2010; Yee, 2006a). Several models of player motivations have been created with the purpose of understanding and categorising individual player motivations and interests (Bartle, 1996; Bateman, Lowenhaupt & Nacke, 2011; Bostan, 2009; Stewart, 2011; Yee, 2006a). These models can give a possible explanation to why different individuals are motivated and engaged while playing games. The first model was created by Bartle (1996), who observed that players in early online multiplayer games displayed different in-game behaviours and were motivated to play for different reasons. Bartle’s model was further updated and empirically grounded by Yee (2005; 2006a; 2006b), with the purpose of identifying what game elements keep players motivated and engaged in modern Massively Online Multiplayer Role Playing Games (MMORPGs). Yee (2006a) identified three overarching components for in-game behaviour and motivation, consisting of 10 subcomponents (see Table 1).

Table 1. *Subcomponents for In-game Behaviour and Motivation Grouped by the Main Component They Fall Under*

<i>Achievement</i>	<i>Social</i>	<i>Immersion</i>
Advancement Progress, Power, Accumulation, Status	Socializing Causal chat, Helping Others, Making Friends	Discovery Exploration, Lore, Finding Hidden Things
Mechanics Numbers, Optimization, Templating, Analysis	Relationship Personal, Self-Disclosure, Find and Give Support	Role-Playing Story Line, Character History, Roles, Fantasy
Competition Challenging Others, Provocation, Domination	Teamwork Collaboration, Groups, Group achievements	Customization Appearances, Accessories, Style, Colour Schemes
		Escapism Relax, Escape from Real Life, Avoid Real-Life Problems

Yee (2006a; 2006b) reported that the demographic factor gender also contributes to differences in player motivations. Female players appear to be significantly more drawn to the social and immersion components in games, while the achievement component is typically experienced as more compelling to male players (Yee, 2006b). Games are therefore reliant on including content and components that can satisfy different types of player motivations if they want to have a sustained and diverse player base. Individual player motivations are as a result important to consider when creating games and learning environments that seek to be motivating and engaging to participate in for different individuals.

2.1.6 Engaged learning

Successful games and effective learning environments share many attributes, where engagement is a critical ingredient in maintaining the learners' attention on the content and activities at hand (De Byl & Hooper, 2013; Whitton, 2010). Engagement is viewed to result from intrinsic motivation, which makes it critical for learning environments to be able to satisfy our innate psychological needs to be effective (Deci & Ryan, 2008; Przybylski et al., 2010). Researchers have listed several key elements that promote engaged learning (De Byl & Hoopers, 2013; Dickey, 2005; Malone & Lepper, 1987). These elements include:

- Clear and focused goals;
- Challenging tasks and activities customised to the learner's skill level;
- Clear instructions and guidelines;
- Protection from adverse consequences on failure. The learners are free to make mistakes without real-world consequences;
- Rapid feedback and affirmation of the learner's performance and behaviour;
- Affiliation and social interactions with others;
- Novelty and variety, which provides intrinsic motivation to explore;
- And meaningful choices connected to the situation.

Games are designed to be engaging, and they have the capability to integrate all of the key elements that promote engaged learning (Dickey, 2005). The inclusion of these elements nurtures effective learning environments that can facilitate different methods of learning.

2.2 Learning theories

Learning theories are conceptual frameworks that concern human learning. There exist multiple learning theories which propose different perspectives on human learning, however there is not a universally agreed upon definition of learning (Schunk, 2012). Schunk (2012, pp. 2) proposes that learning “involves acquiring and modifying knowledge, skills, strategies, beliefs, attitudes and behaviours.” The learning theories behaviourism, cognitivism, and constructivism have been dominant in the field of research and in the creation of instructional environments for many decades. Most learning theories posit that learning occurs within individuals, sometimes with aid from other people, while Siemens (2014) argues that learning no longer only occurs inside individuals, but also occurs outside of people with the aid of technology. Siemens (2014) highlight that the dominant learning theories were developed in a time without high impact of technology, and are therefore not capable of sufficiently accounting for new learning processes and needs in our modern and digital society. New learning theories have emerged, built on the foundation of existing theories, which propose updated perspectives on learning (Illeris, 2018; Siemens, 2014).

2.2.1 Connectivism

The learning theory called connectivism offers a perspective on learning focused on the digital age. Connectivism emphasises that learning can no longer be viewed as a purely internal activity in individuals, but is affected by the social and cultural context the individuals are in, as well as the tools being used (Siemens, 2014). The theory highlights the importance of being able to filter and assess information, as well as the ability to know which connections or tools to utilise to learn more (Siemens, 2014). Connectivism views personal experience as an important factor in the learning process, while emphasising that knowledge can also be derived from the experiences and connections made by others. Siemens (2014) highlights that the information development in our digital society is rapid, which changes the worth of certain knowledge and jobs over short time, making it crucial for individuals to be able to efficiently acquire new knowledge and skill sets.

Connectivism portrays relationships and networks as sources of knowledge that can be tapped by individuals in order to acquire the necessary information and knowledge to innovate and form solutions to problems (AlDahdouh & Caires, 2015; Siemens, 2014). Connectivism views networks to consist of people, books, websites, software, and databases, which are connected either by the internet, intranet, or direct contact (See Figure 1) (AlDahdouh & Caires, 2015). These networks and connections between people and technology enable knowledge to be stored

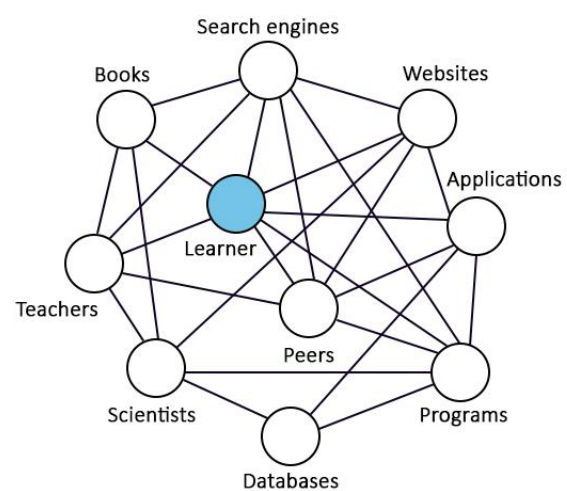


Figure 1. Knowledge Network

externally, and can be retrieved when needed (Siemens, 2014). The ability to learn new things and acquire the right knowledge by forming and navigating networks is therefore viewed as more critical than the ability to memorize information and reproduce content, as it enables individuals who are part of networks to develop new knowledge and skills (Siemens, 2014).

2.2.2 21st century skills

With the rapid changes in our modern and digital society, educators, researchers, and business leaders have identified certain skills and competencies that are critical for individuals to have to be successful in the 21st century society and workforce (National Research Council, 2013; Rotherham & Willingham, 2010). These skills and competencies have therefore been named the 21st century skills. The skills and competencies considered as 21st century skills vary, where multiple frameworks have been developed (National Research Council, 2013; P21, 2015; World Economic Forum, 2015). The Partnership for 21st Century Learning (P21, 2015) has defined four crucial learning and innovation skills, dubbed the 4C's (see Figure 2). The skills consist of creativity, critical thinking, communication, and collaboration.

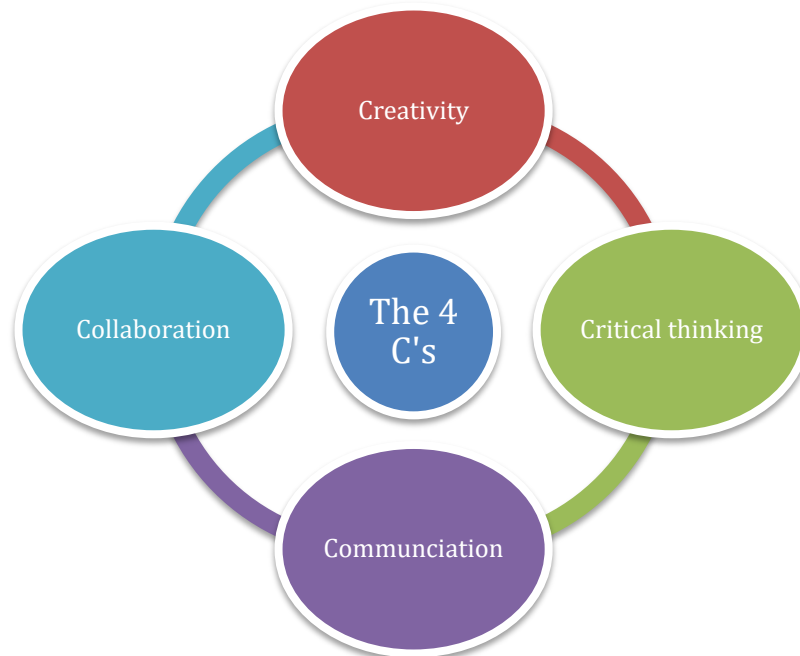


Figure 2. *The 4Cs of 21st century skills*

Additional skills and competencies that are considered crucial to develop include, but are not limited to, problem solving, conflict resolution, information literacy, ICT literacy, flexibility, and persistency (National Research Council, 2013; P21, 2015; World Economic Forum, 2015). The 21st century skills are interwoven with the concept of deep learning. Deep learning concerns approaches to learning that promote the construction and development of skills, knowledge and content, as well as the application and transfer of skills and knowledge from one area to another (Entwistle, 2003; National Research Council, 2013). Entwistle & Waterson (as cited in Offir, Lev, & Bezalel, 2008) have defined multiple deep learning

processes, which include proposing solutions to problems, assessing advantages and disadvantages of a situation, developing strategies, creating new information from existing information, handling problems in a wider perspective, and connecting facts, ideas and concepts in order to interpret, propose or judge. Teachers can promote deep learning and the development of 21st century skills by utilising student-centred teaching methods (Guo & Wu, 2017).

2.2.3 Student-centred learning

Student-centred learning can be viewed as an umbrella term for methods of teaching that shift the focus of instruction from the teacher to the student (Baeten, Struyven & Dochy, 2013). Student-centred learning approaches focus on placing the student at the centre of their own learning by making them active participants in the learning activities as opposed to passive listeners (Kember, 1997). The overall aim of student-centred learning is to foster the development of learner autonomy and responsibility (Hannafin & Hannafin, 2010), as well as deep learning and understanding (Baeten, Kyndt, Struyven & Dochy, 2010; Entwistle, 2003; Lea, Stephenson & Troy, 2003). In a student-centred classroom, the teacher assumes the role of a guide by facilitating learning activities and directing the students' learning processes (Jones, 2007).

The term student-centred learning can refer to different educational views (Lea et al., 2003), which primarily differ based on the amount of responsibility and accountability placed on the students. In one view, the students assume responsibility for choosing their own learning goals, methods of learning, pace, as well as the monitoring and assessment of their own learning (Hannafin & Hannafin, 2010). In another view, the students do not typically select their own learning goals, methods and assessment type, but are participants in a classroom environment that recognises and promotes the individual differences and needs of the learners (Jones, 2007). The concept of differentiated learning is therefore often integrated in student-centred learning approaches. Differentiated learning, also known as differentiated instruction, is a teaching method with the goal of recognising student differences and their individual needs, and to adjust the instruction and learning activities accordingly (Grimes & Stevens, 2009). This teaching method is used to provide instructions, activities, and assessment that benefit students of different knowledge and skill levels, in addition to other specific needs (Grimes & Stevens, 2009). Grimes and Stevens (2009) state that differentiated learning classrooms include several elements, such as student responsibility, student choice, peer tutoring, flexible grouping, and modified instruction. The overall philosophy of the teaching method is that teaching is the most effective when the provided instructions, educational content, activities and scaffolding meet the current needs of the learners (Tomlinson, 1999).

2.2.4 Instructional scaffolding

Instructional scaffolding is a concept originating from the theory zone of proximal development (ZPD), which was developed by Vygotsky (1978). The theory is a measurement of what a learner is capable of alone, and what the learner is capable of achieving with assistance from more knowledgeable others (see Figure 3).

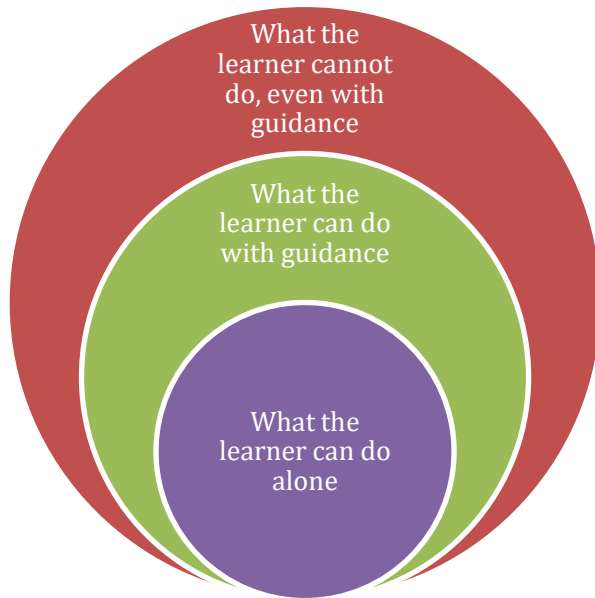


Figure 3. *The Zone of Proximal Development*

of strategies to reach set goals, and self-monitoring and self-evaluating performance and progress (Dabbagh, 2003). The scaffolding provided to learners can gradually cease as they gain more knowledge, skills, and confidence in their abilities to complete tasks independently (Dabbagh, 2003).

There are multiple scaffolding techniques that teachers and tools, such as games, can utilise to promote student learning. Sawyer (2005) highlights that the provided scaffolding should be tailored to the specific learners, based on their current knowledge, skills, and needs to be effective and contribute to learning. One scaffolding technique is to provide the learner with hints that enable the learners to figure out the challenge on their own (Sawyer, 2005), while another technique is to provide the learners with the possibility to model thinking and development processes through “think aloud” techniques or visualisations (Dabbagh, 2003). The provision of useful resources and feedback on performances and progress are also viewed as scaffolding techniques, which can promote student engagement and motivation (Dabbagh, 2003). Dabbagh (2003) stresses that it can be challenging to find the right balance of scaffolding, as some learners require little to no scaffolding, while others may require a lot. Scaffolding is viewed as particularly critical to provide in student-centred teaching methods that emphasise unguided or minimal guided instruction (Kirschner, Sweller, & Clark, 2006; Mayer, 2004). Methods such as experiential learning prove to be less efficient and effective if there is lack of scaffolding connected to the content and appropriate strategies for learning (Kirschner et al., 2006; Mayer, 2004).

When learners are provided assistance, they are in other words enabled to construct knowledge or perform actions they otherwise would be incapable of (Obukhova & Korepanova, 2009). Instructional scaffolding refers to the support provided to learners by teachers or others in the learning environment during the learning process (Sawyer, 2005). The goal of scaffolding is to assist the learners to effectively construct their own knowledge, promote deep learning, assist them in reaching specific goals, and become self-regulated (Dabbagh, 2003; Sawyer, 2005). Self-regulation can consist of goal setting, seeking help, time planning and management, the deliberate use

2.2.5 Experiential learning

Experiential learning is student-centred approach to learning. The theory is built upon the works of Dewey, Lewin and Piaget (Fry & Kolb, 1979; Kolb, 1984). The theory seeks to form a holistic and integrative view on learning by combining the significance of experience, cognition, perception and behaviour (Kolb, 1984). Kolb's (1984) experiential model of learning is depicted as a four-stage cycle comprised of concrete experience, reflective observation, abstract conceptualisation, and active experimentation (see Figure 4).

The theory emphasises that learning is an adaptive and continuous process grounded in experience, where knowledge and meaning are continuously created and modified. Kolb (1984) argues that for individuals to be effective learners, they need to develop the abilities to involve themselves in new situations, to critically reflect on situations from different perspectives, form theories from concepts and observations, and integrate the theories in their decision-making and problem solving. Teachers can support this experiential learning process by facilitating new experiences, scaffolding the students' ability to reflect, assisting them in forming generalisations and hypotheses to explain observations and experiences, as well as enabling them to experiment with the formed hypotheses to form new experiences. Experiential learning shares many attributes with the concept of situated learning, which views knowledge and learning as occurring from active participation in authentic contexts (Brown, Collins & Duguid, 1989).

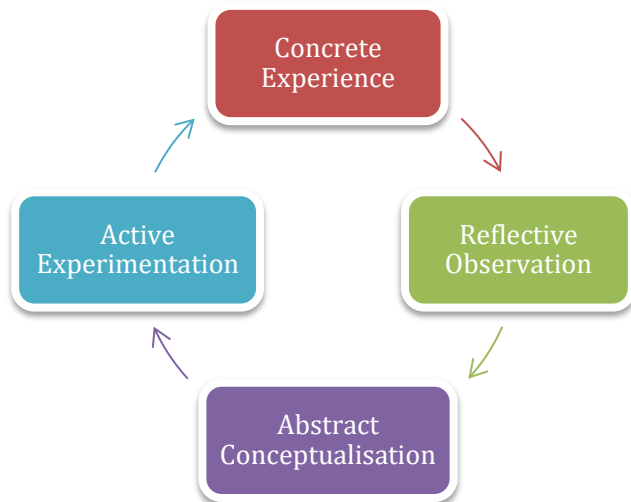


Figure 4. *The Experiential Learning Cycle*

2.2.6 Situated learning

The situated learning theory proposes that learning is situated and affected by context, and is particularly connected to interactions between the learner, social factors, and the environment he or she is in (Lave, 1991). In authentic situations, knowledge is not contained solely within the individual, but distributed throughout the environment as individuals can seek guidance from others or use resources such as technology to acquire new information and knowledge that aid in problem solving (Siemens, 2014; Young, 1993). The situated learning theory posits that learning is the most effective when it takes place in contexts in which the reasons for learning certain knowledge or skills are made clear to the learners (Young, 1993). When learners are immersed in realistic contexts, the necessity of specific knowledge or skills are made evident by the events and challenges taking place (Young, 1993). This enables learners to experience and observe the potential worth of certain knowledge and skills, thus giving learners reasons for why they need to learn it (Young, 1993).

Situated learning can be designed for classroom use, but there are key attributes that the integrated situations must contain in order to be perceived as authentic (Young, 1993). According to Young (1993), the situations must to some degree include real-life problem solving, complex goals, opportunities to detect relevant versus irrelevant information, active engagement from the learners in finding and solving challenges, and opportunities to engage in collaborative and social activities. Situated learning can however be hard for teachers to facilitate, as the teaching method is complex and challenges both the teacher and the students. The method requires teachers to be comfortable with risk-taking and be willing to give some control over the learning environment to the students (Young, 1993). The situated learning environment itself aids in scaffolding the learners as they are prompted to learn and perform actions that are important in the situation; yet the teacher's role during situated learning activities does not become easier (Young, 1993). He or she must still coach, observe, and assess the interactions of the learners within the situated context. The teacher also has responsibility for facilitating and supporting the students in transferring the knowledge and skills used in the learning situation over to other contexts.

2.2.7 Transfer of learning

Transfer of learning is a concept of central importance in education, as one of the goals of educators is to aid students in transferring their learning from one task to the next, between school and home, and from school to workplace (National Research Council, 2000). Transfer of learning can therefore be defined as the transfer of knowledge and skills gained in one context to another (Perkins & Salomon, 1992). Perkins & Salomon (1992) highlight that the transfer of learning has been successful when knowledge and skills acquired in one context impacts the individual's performance in other contexts or with related material. Perkins & Salomon (1992) use the terms near and far transfer to categorise aspects of transfer. Near transfer refers to learning being transferred to contexts and performances that are closely related to the one the learning occurred in, whereas far transfer refers to the transfer of learning to comparatively different context and performances (Perkins & Salomon, 1992). For example, near transfer can be the transfer of learning from one school task to a similar school task, while far transfer can be the transfer of learning from school subjects to the workplace (National Research Council, 2000).

Successful transfer of learning is according to the National Research Council (2000) influenced by several factors. Students must first have an adequate grasp on the content and skills in the initial context before the learning can be expected to be transferred to another. It is also not enough for students to simply memorise facts, information, and fixed sets of procedures, as a deeper understanding of the content is necessary to transfer it to other problems or contexts. Learning is also time-consuming. Many students need extra time and scaffolding to generate connections between what they are learning in school settings and how it connects to other information they possess, as well as the potential meaning or worth for them as individuals (National Research Council, 2000). To enable transfer, teachers should cover topics which are connected to each other, help the students process organising principles, provide them with enough time to process information, and provide opportunities

to actively discuss and utilise the desired knowledge and skills (National Research Council, 2000). Transfer of learning should therefore be viewed as an active and dynamic process including both the teacher and students, instead of a passive end-product resulting from the completion of tasks and activities (The National Research Council, 2000).

2.3 Facilitating the use of new teaching tools in education

Researchers argue that there are many factors that influence the integration of new teaching tools in education, including teachers' pedagogical beliefs, self-efficacy, and school context (Adamy & Boulmetis, 2006; Bandura, 1977; Ertmer, 2001; Jamieson-Proctor, Burnett, Finger & Watson, 2006; Scrimshaw, 2004; Tondeur, van Braak, Ertmer & Ottenbreit-Leftwich, 2017).

2.3.1 Pedagogical beliefs

Teachers' pedagogical beliefs are viewed as a crucial factor in determining their classroom practice (Ertmer, 2005). Pedagogical beliefs can be defined as "[...] the understandings, premises, or propositions about teaching and learning that we hold to be true" (Tondeur et al., 2017). To further specify, pedagogical beliefs can be about the nature of knowledge and learning, confidence to perform, and perceptions of self (Ertmer, 2005). Teachers' pedagogical beliefs are therefore influencing which teaching strategies and tools they utilise in their classroom practice, as they are more likely to integrate strategies and tools that align with their beliefs on what 'good' education looks like (Tondeur et al., 2017). In studies about technology integration in schools, the researchers discovered that teachers whose beliefs and teaching strategies are learner-centred tend to use technology as a teaching tool more frequently than teachers with teacher-centred beliefs (Becker, 2000; Tondeur et al., 2017). They are also more likely to use the tool to facilitate learning activities that promote deep learning and skill development (Berg, Benz, Lasley & Raisch, 1998). Studies on the use of technology in schools also revealed that teachers' self-efficacy, which is connected to individuals' perception of self, is another important factor in the integration of new teachings tools (Adamy & Boulmetis, 2006; Ertmer, 2001; Jamieson-Proctor, Burnett, Finger & Watson, 2006).

2.3.2 Self-efficacy

Self-efficacy can be viewed as a personal judgement of own knowledge and abilities to achieve specific goals (Bandura, 1977). Researchers describe four primary sources that influence self-efficacy: (1) knowledge gained through vicarious experiences, (2) social persuasion, (3) physiological indicators (stress vs relaxation), and (4) personal mastery (Bandura, 1977; Ertmer, 2001; Schunk, 2012). Vicarious experiences include acquiring knowledge from other sources than direct experience, such as by observing others or reading books, while social persuasion involve encouragement or discouragement from others. Physiological indicators concern individuals' perception of their responses, for example their reaction to stressful situations, which impact their perception of self and own abilities. Personal mastery is viewed to be the most important influencer of self-efficacy, where experienced success increases self-efficacy and experienced failure lowers it (Bandura, 1977). However, the degree of which teachers are influenced by the primary sources also depend on other factors, such as their current skill level with the tool in question, their pedagogical beliefs, and their attitudes towards the tool (Ertmer, 2001). Research on technology integration in classrooms revealed that as teachers' self-efficacy connected to technology increased, so did their motivation and subsequently the use of technology in classroom instruction (Ertmer, 2001). Teachers' degree of self-efficacy is therefore viewed as an important and contributing factor to the facilitation of new teaching tools in education.

2.3.3 School context

Another factor that influences the facilitation of new tools in classrooms is the school context. Schools' leadership, culture, local curriculum, resources, and support staff are all elements that influence the successful integration of new and innovative teaching tools (Scrimshaw, 2004). Teachers in schools that have a leadership that is collaborative, includes others in decision-making, and is supportive of innovation and risk-taking are more likely to integrate new teaching tools to support student learning (Scrimshaw, 2004). The overall school culture teachers participate in is also found to influence the integration of new tools (Ertmer & Ottenbreit-Leftwich, 2010). Somekh (2008, p. 450) argues that "[...] teachers are not 'free agents' and their use of ICT for teaching and learning depends on the inter-locking cultural, social and organisational contexts in which they live and work." Teachers' pedagogical beliefs about what good teaching practices are and which tools can be utilised to facilitate learning activities may or may not align with the ingrained school culture and teaching practices, which influences the amount of support teachers receive for their classroom practices (Ertmer & Ottenbreit-Leftwich, 2010). The adoption of new innovative tools in schools therefore also depends on the conformity within the school culture (Ertmer & Ottenbreit-Leftwich, 2010). Additionally, the school's infrastructure of accessible equipment, resources, and personnel also impact teachers' options regarding which tools they can integrate in lessons to facilitate different learning activities (Scrimshaw, 2004). Equipment, resources, and resource personnel can either facilitate or limit the use of teaching tools in classrooms, depending on whether they are easily accessible and reliable (Butler & Sellbom, 2002; Scrimshaw, 2004).

2.3.4 Professional development

Professional development is important to facilitate changes and developments in teachers' pedagogical beliefs and self-efficacy. Professional development concerns acquiring knowledge and skills connected to teaching practices, educational tools, and the practical integration of new methods and tools to support student learning (Lawless & Pellegrino, 2007). Borko & Putnam (as cited in Ertmer & Ottenbreit-Leftwich, 2010) highlight that knowledge is a critical factor in professional development, where teachers need help to expand and elaborate their knowledge systems. Teachers' professional development can be promoted by providing them information, resources, and learning activities that are perceived to be coherent and have meaning for them as professionals (Lawless & Pellegrino, 2007). The provided information and learning activities should therefore make connections with other goals and activities connected to teaching, and align with state and district standards regarding content and assessment (Lawless & Pellegrino, 2007). Teachers can also receive help connected to knowledge construction and skill development through direct or indirect guidance by others (Lawless & Pellegrino, 2007). Guidance can be provided by multiple sources, including colleagues, professional literature, development programs, state and local policies, as well as other information rich resources such as websites. While a lot of support for integrating new tools can be provided locally at schools, Scrimshaw (2003) argues that teachers who are ahead of their schools, or do not conform to the school culture regarding innovation, must involve external sources of support for professional development. Online technology and media are therefore viewed as powerful resources, enabling teachers to get easy access to information and the possibility to receive support and validation from other professionals both synchronously and asynchronously (Dede, Ketelhut, Whitehouse, Breit & McCloskey, 2009; Scrimshaw, 2003).

3 Methodology

3.1 Choice of methods

For the study it was important to evaluate which research approaches and methods are beneficial to utilise for the data gathering and analysis in each stage of the research. Both qualitative and quantitative approaches to the research were evaluated. The goal of qualitative research methods is to gain a deeper understanding of the research area and the participants' situations (Carr, 1994). The strengths of qualitative methods are the flexibility and the capability to facilitate more in-depth exploration of subjective experiences (Carr, 1994; Holme & Solvang, 1998). However, as qualitative methods aim to capture the character and situation of the respondents, it can be challenging to determine whether this data is valid and representative for others in the target population (Holme & Solvang, 1998). Qualitative methods and analysis are also time-consuming and greatly relies on the researcher's skills (Choy, 2014). Quantitative research uses methods to collect data that can be quantified and measured, where advanced statistical analysis techniques can be utilised to create generalizations, predictions, and representations of the studied population (Holme & Solvang, 1998). One of the strengths of quantitative methods consists of being able to efficiently and effectively compare data as the participants are given identical questions (Holme & Solvang, 1998). Quantitative methods also enable clear documentation regarding the data gathering and analysis, which aids other researchers in replicating and comparing the results (Yauch & Steudel, 2003). However, quantitative methods have potential weaknesses. They are inflexible once the study has begun, fail to thoroughly describe the respondents' experiences (Choy, 2014), and the obtained data contains no descriptions of the respondents' underlying logic or context behind the answers (Yauch & Steudel, 2003).

Both qualitative and quantitative methods were chosen to be used in the first research stage of the study, while only qualitative methods were selected for the second research stage (see Figure 5). A quantitative research method was chosen to efficiently be able to measure teachers' use of games in education, perceived challenges of use, as well as the potential usefulness of different digital supplementary resources. However, since the quantitative research approach is unable to gather in-depth contextual information, the decision was made to utilise qualitative research methods alongside the quantitative data gathering. The qualitative research methods were used to gather context-specific data connected to the research questions, particularly connected to personal experiences and perceived challenges of using games in education, with the goal of facilitating a deeper exploration of the topics. The primary goal in stage two of the research was to evaluate whether access to digital supplementary resources connected to games increases teachers' willingness or desire to utilise games as teaching tools in class. Qualitative methods for data gathering and analysis were selected for this stage in order to better explore and understand the teachers' situations and experiences.

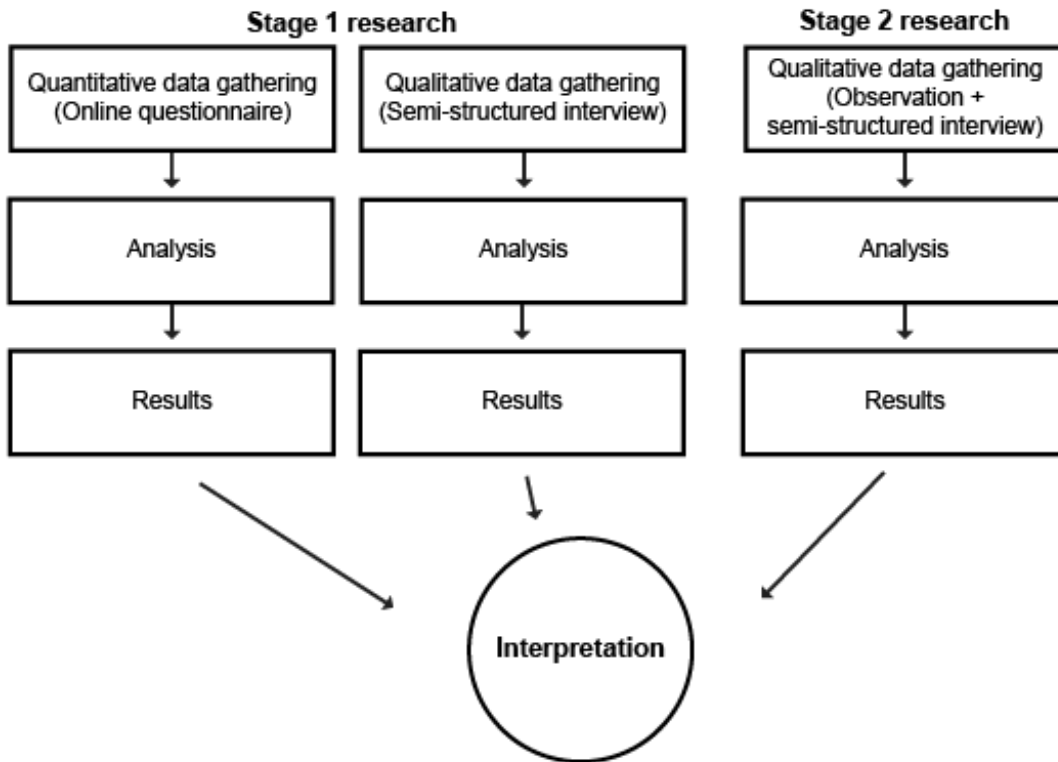


Figure 5. *The Research Process and Utilised Research Methods*

The integration of both qualitative and quantitative methods can be defined as mixed methods research (Creswell & Creswell, 2017). Mixed methods research has certain advantages as it utilises the strengths of additional methods to overcome the weaknesses in other methods, which enables the researcher to gain a broader understanding of the areas of research (Creswell & Creswell, 2017; Holme & Solvang, 1998). The integration of mixed methods may therefore also strengthen the validity of the methods and research findings (Kelle, 2006). Parallel data gathering was conducted during the first stage, in which the data was gathered with both qualitative and quantitative methods within the same span of time (Creswell, Plano Clark, Gutmann & Hanson, 2003). The data, analysis and the resulting findings from the different methods were weighted equally in the research. The quantitative data was gathered using an online questionnaire featuring close-ended questions, while the qualitative data was collected using semi-structured interviews and through open-ended questions in the online questionnaire. The data in stage two of the research was collected using the qualitative methods observation and semi-structured interviews.

3.1.1 Online questionnaire

Questionnaires offer an objective way of gathering information about individuals' attitudes, knowledge, beliefs, and behaviour (Boynton & Greenhalgh, 2004). The questionnaire was developed specifically for this study. It was created using Google Forms, enabling it to be efficiently distributed to potential participants. Online questionnaires also enable effective digital storing of the responses, while providing real-time results. The questionnaire was created to incorporate both close-ended and open-ended questions. Close-ended questions were utilised in order to collect and compare measurable data about the respondents, while open-ended questions were included to collect data which is both challenging and restricting to gather using pre-determined categories. The questions in the questionnaire were presented in various formats, including drop-down questions, different types of rating scale questions, multiple-choice questions, and open text fields. Skip logic was utilised to enable the respondents to progress through the questionnaire in different ways, depending on their answers to particular questions.

3.1.2 Semi-structured interview

The prevailing methods of data collection associated with qualitative research are interviews and observation (Hoepfl, 1997). While the general purpose of interviews is to get to understand the interviewee's situation better, there are multiple interview formats to choose from, where the format should be selected based on the planned research questions and analysis methods (DiCicco-Bloom & Crabtree, 2006). The semi-structured interview format was selected for use in data gathering in both stage one and two of the research, due to the format's capability of enabling great flexibility and in-depth discussion of topics (Holme & Solvang). Semi-structured interviews tend to be organised around an interview guide, which is a set of predetermined open-ended questions; yet the format allows for questions to emerge or be modified based on the responses of the interviewees (DiCicco-Bloom & Crabtree, 2006; Holme & Solvang, 1998).

An interview guide was developed and utilised during the interviews in both stage one and stage two of the research, which served to guide the conversation and to ensure that the different topics were covered. The purpose of the interviews in stage one was to learn more about teachers' use of games in education, their attitudes towards games, experienced challenges of using games, and the potential usefulness of digital resources. The purpose of the stage two interviews was to gain insight into the experiences and thoughts of the teachers who tested the board game Words of Power along with the accompanying digital supplementary resources in their lessons. The semi-structured interviews in stage two aimed to answer whether the teachers find themselves more willing or have a larger desire to utilise games as teaching tools when they have access to digital supplementary resources connected to games.

3.1.3 Observation

The qualitative method observation involves observing people and situations in natural settings in order to gain insight on their behaviours and interactions (Mays & Pope, 1995). Observational methods can also include the researcher participating and asking questions in the observed situation (Mays & Pope, 1995). Observation as a method was chosen for use in the research in stage two, with the goal of gathering information on the practical implementation of the board game and the digital supplementary resources in classroom situations. The conducted observation was overt; the participants were informed of the goals of the observation in order to build trust, avoid the feeling of deception, and to make it more acceptable for the researcher to take notes during the observation (Holme & Solvang, 1998). Observation can however trigger the Hawthorne effect, in which the observed participants alter their behaviour as they are aware of being observed (Jones, 1992). The observation was conducted passively, with the aim of reducing the researcher's influence on the participants' behaviour in order to be able to observe a more authentic situation (Holme & Solvang, 1998). During and after the observations, the researcher wrote field notes in order to record evidence of the observation. The notes taken during the observation consisted of both descriptive information and reflective information (Labaree, 2018). Description information consists of factual data, such as time, date, setting, and descriptions of situations, while reflective information features the researcher's reflections about the observation (Labaree, 2018).

3.2 Participant recruitment and data gathering procedure

All of the recruited participants in the research currently work, or have previously worked, as teachers in Norway. Only teachers were recruited as participants as the goal of the data collection was to gather information on teachers' attitudes to games, use of games, the perceived challenges of using games, and the potential usefulness of digital resources connected to game use. Different approaches to participant recruitment were utilised for the chosen research methods. The overall sample size of participants in the study is 66, where there were 60 participants in the online questionnaire, 4 participants in the semi-structured interviews in stage one of the research, and 2 participants in stage two of the research, who participated in the observations and semi-structured interviews.

3.2.1 Online questionnaire

The participants in the online questionnaire were recruited through email inquiries. Emails containing general information about this project and the questionnaire were sent to principals at elementary schools, lower secondary schools and upper secondary schools in the counties of Aust-Agder and Vest-Agder in Southern Norway. The emails also included a link to the online questionnaire, which the principals were encouraged to forward to the teachers working at their schools. This method of recruiting ensures that the respondents work in the sought after profession. The participants who followed the email link were presented with brief information about the purpose of the questionnaire, the estimated time of completion, reassurance about their anonymity, as well as the research conductor's contact information.

The participants then answered the online questionnaire, consisting of multiple question types.

3.2.2 Semi-structured interviews, stage one research

Semi-structured interviews were held in two stages, where each stage was comprised of different participants. The participants were approached and recruited based on the criteria age, gender, and work experience as a teacher. These criteria were set in order to promote a diverse selection of participants within the occupation, with the aim of gaining an understanding of the use of games in education from different perspectives. The participants were contacted and recruited through email or by phone. Four participants were recruited and interviewed in this stage. All of the recruited participants were ethnically Norwegian. In future work it would be preferable to also include more ethnic diversity to further promote a diverse selection of participants.

The recruited participants were briefed on the topics and purpose of the interview, both orally and in writing. The participants were asked for permission regarding the use of a smartphone to record the audio during the interview. They were also informed that the audio records would be promptly deleted after the interview had been transcribed. Notes were taken using pen and paper during interviews in environments with significant interfering noise. The written notes consisted of keywords, phrases, and in some cases whole sentences. Interview answers were able to be recorded in two of the interviews, while in the remaining two the data was recorded by taking notes. Half of the interviews were conducted face-to-face, while the other half was conducted digitally through software providing both audio and video feed.

3.2.3 Preparation for stage two research

The two teachers participating in stage two of the research were sent an email with the link to the created website containing the digital supplementary resources. As the resources required time to create, participant 1 was only given access to the resources 4-5 days before the scheduled classroom implementation. Participant 2 had scheduled the implementation at a later date, and therefore had three weeks of potential preparation time with the given digital supplementary resources. The participants were also sent a document via email containing information about the purpose and process of the research and testing. This document was written in order to enable the teachers to distribute it to the students' parents. An introductory meeting was held with the individual participants before the practical game implementation for an informal talk about the game. During the talk the participants were shown the game, where they could freely ask questions regarding rules and implementation. The participants were offered to receive the classroom set of the game before the practical classroom implementation. The participants accepted the offer and requested access to the game 1-3 days before implementation.

3.2.4 Observation and semi-structured interviews, stage two research

The participants in stage two of the research were recruited based on three criteria. First, they were required to currently work as English teachers in the Norwegian school grades 5 - 9. Second, they had to be willing to implement a board game created by the research conductor in their classroom. And third, they had to be willing to be observed during the classroom implementation and be interviewed afterwards. The first criterion was chosen due to the board game being designed for use in English classes. The educational content of the game was based on vocabulary and themes commonly encountered in lesson plans in grades 6. - 8. Prior testing of the game revealed that the educational content also fit the skill levels of slightly younger and older students. The grade criterion was therefore expanded in order to make it easier to find participants for the research. Potential participants from local schools were contacted via email. Two participants were recruited for this stage. The participants were recommended to the research conductor by one of the supervisors in the study. Participant 1 is a 36-year-old male working as an English teacher in 8th grade, whereas participant 2 is a 46-year-old female working as an English teacher in 5th grade. In future studies it would be beneficial to include a larger sample size regarding the practical use of games and the benefits of supplementary resources in classroom implementation. The research conductor and participants agreed to meet 15 minutes before the integration and observation of the game in classroom use. There were a total of three observation sessions, where two were with the teacher teaching 8th grade, and one with the teacher teaching 5th grade. The observation sessions in 8th grade lasted for 1 hour each, whereas the observation session in 5th grade lasted for 1 hour and 45 minutes. At the beginning of the observation sessions, the researcher introduced herself to the students in class and briefly communicated the purpose and the process of the observation. It was emphasised that the focus of the research and observation is on the teachers and their experiences of using games lessons, and that the researcher will not actively participate in the class. Field notes were recorded during the observation sessions, and further refined after the sessions.

Semi-structured interviews were conducted after the teachers had implemented the game Words of Power in one or two lessons, with the aid of the created digital resources. The interviews were conducted face-to-face in a meeting room at the participants' workplace. The interviews lasted approximately 20 minutes. The interview with the teacher in 8th grade was conducted immediately after the second session of classroom observation, while the interview with the teacher in 5th grade was conducted one hour after the observation session. The participants were briefed on the purpose of the interview, and they were asked for permission regarding the use of a smartphone to record the audio during the interview. They were also informed that the audio records would be promptly deleted after the interview had been transcribed. Both interviews were audio recorded.

3.3 Analysis methods

3.3.1 Quantitative data

The quantitative data from the questionnaire was gathered in a Google Sheets document and analysed using different analysis techniques. The filtering system in the software enables specific data to be shown depending on predetermined criteria. The method cross tabulation was utilised to list and analyse the relationship between multiple variables. The method is used to identify patterns, trends, and probabilities within raw data (Aprameya, 2016). The basic analysis technique arithmetic mean was used to determine the average sum of the data collected through different rating scale questions. The technique was selected due to its accuracy in determining the central tendency in data sets with no dispersing data points that skew the distribution. Some responses were also calculated into percentages, in order to describe and summarize the number of responses in each category. Different graphs were utilised to present and compare categorical data.

3.3.2 Qualitative data

The collected qualitative data was analysed using the analysis method content analysis, where the process was based on the Taylor-Powell & Renner (2003) approach. Content analysis is a method for analysing and interpreting narrative and textual data, including open-ended questions and comments, interviews, and observations (Taylor-Powell & Renner, 2003). Content analysis can be viewed to blend both qualitative and quantitative properties, as the analysis method can capture subjective experiences and concepts, while quantifying certain data through the counting of codes (Insch, Moore & Murphy, 1997). This yields a potential for high reliability connected to measurements and flexibility of use (Insch, Moore & Murphy, 1997).

The recorded audio files from the interviews were transcribed in Google Docs. The data collected by taking notes during two of the interviews and observation sessions was refined digitally, where some filler words and helping verbs were added to help extend the meaning of key notes and phrases. The textual data from the interviews and observations was organized into data documents, with one document per participant. Each document was assigned codes by using words or phrases to describe the content, with the purpose of designating data segments that contain similar information (Morgan, 1993). A code list was formed containing all individual codes, in addition to a side-by-side overview of the codes used in each data document. The side-by-side overview enabled the research conductor to detect prominent and frequent code use. The individual codes were then colour-coded and organized into coherent categories, formed based on the similarities of the codes. The categories were used to form an overview of themes and sub-themes that had emerged from the data. The themes and sub-themes were designated supportive quotations from the interview participants.

The qualitative textual data from the online questionnaire was analysed with a focus on how the individuals responded to each individual open-ended question. The responses to each question were organized into a data document, where the responses were coded and assigned to emerging categories and sub-categories. The researcher then counted the amount of responses per category. Single classification of codes was chosen over multiple classifications, where each code was assigned to the category deemed the best fit, instead of being assigned to multiple relevant categories (Insch, Moore & Murphy, 1997). This decision was made partly due to labelling restrictions in the used software, and partly to restrict codes to the category in which they are interpreted to show direct concern (Insch, Moore & Murphy, 1997).

3.4 Reliability and validity

Reliability and validity are two issues which are closely tied together that are important to address regarding methodology and the findings of the research. Reliability concerns the repeatability and reproducibility of the results, and the predictable accuracy of the findings from the sample size in relation to the population size (Golafshani, 2003), the stability of measurements over time (Hoepfl, 1997), as well as the degree of measurement errors in the utilised data gathering methods (Morse, Barrett, Mayan, Olson & Spiers, 2002). Validity determines whether the research was conducted in pre-defined and validated ways, measured what it was intended to measure, and how trustworthy or factual the results are (Golafshani, 2003). It is therefore important that the researcher gives full accounts of the methods that have been utilised in the data gathering and analysis of the research, and explains evaluations and inferences that have been made. The question of validity can also concern the responses of the participants in the research, as the information the respondents share may be truthful or false. Qualitative research seeks to gain insight on individuals' experiences, behaviours and situations, which are abstract phenomena which cannot be measured and evaluated in the same way as in quantitative research. It can therefore be more challenging to evaluate the validity of qualitative research (Golafshani, 2003).

Researchers cannot ensure full reliability and validity of their findings; however they can take steps to minimize factors which threaten the reliability and validity of the research (Golafshani, 2003). Assessing the trustworthiness of the research can be done by evaluating the criteria internal validity, external validity, reliability, and objectivity (Hoepfl, 1997). These terms are commonly used in quantitative research, whereas many qualitative researchers use the terms credibility, transferability, dependability, and confirmability, respectively (Hoepfl, 1997; Lincoln & Guba, 1985; Morse et al., 2002). Internal validity refers to the extent in which the findings describe reality, which depends on multiple variables including sample size, while credibility depends less on sample size than on the analytical skills of the researcher and the richness of information gathered from the respondents (Hoepfl, 1997). Techniques for assessing credibility include the use of multiple methods to gather and analyse the data, and enabling other researchers to assist in the gathering and analysis process (Hoepfl, 1997). External validity concerns the ability to generalize the findings and apply them to different contexts, while transferability refers to

how the findings can be transferred to different situations (Hoepfl, 1997). Lincoln & Guba (1985, p. 124) highlight that it is unreasonable to expect the researcher to “[...] indicate the range of contexts to which there might be some transferability”, but that the researcher should supply sufficient information in order to enable other researchers to make judgements on areas where the findings are transferable. While reliability connected to quantitative research concerns reproducibility, repeatability, and stability; Lincoln & Guba (1985, p. 316) state that in qualitative research “[...] there can be no validity without reliability”, and that “a demonstration of the former is sufficient to establish the latter.” Based on this argument, the reliability of qualitative research is highly dependent on the validity of the research. Reliability can therefore in qualitative research be increased by ensuring high credibility regarding the research methods and results (Hoepfl, 1997). Objectivity concerns the degree in which the conducted research is affected by the bias and values of the researcher. Research which relies on quantitative methods is commonly viewed as more objective than qualitative research, due to quantitative research being relatively value-free while qualitative research relies on the researcher’s interpretations and is therefore value-bound (Hoepfl, 1997). There are arguments that research can never be fully objective, and that researchers should strive to be non-judgemental and attempt to report the findings in a balanced way (Hoepfl, 1997). Confirmability concerns the researcher’s ability to demonstrate and interpret the research in a neutral and non-judgemental way. Researchers can demonstrate this by providing data and information connected to the data gathering and analysis processes, such as the raw data, analysis and process information, and the reconstruction and synthesis products (Hoepfl, 1997; Lincoln & Guba, 1985).

All of the data in this study was gathered and analysed by one individual. Data gathered and analysed by one person using qualitative methods have lower credibility and reliability than if there were multiple researchers participating in the processes. Yet, the research can still be argued to be credible and reliable as it was conducted using a mixed methods approach. When using mixed methods, the weaknesses of one method can be counterbalanced by the strengths of another (e.g. quantitative data is not in-depth and contextual, but can be generalized, whereas qualitative data is in-depth and contextual, but hard to generalize to other people). The mixed methods approach therefore leads to a higher internal validity, external validity, and reliability of the results.

During the creation of the online questionnaire, the research conductor selected questions and question formats deemed appropriate for what was being measured. The questionnaire was also checked and confirmed by a research supervisor before it was distributed to potential respondents, in order to ensure that the added questions, formats, and structure were appropriate for the study and that the questions were worded objectively and in a polite and instructive way. However, as the questionnaire has only been utilised to gather data from one sample, it is impossible to state whether it will yield consistent results over time from repeated samples (Boynton & Greenhalgh, 2004).

Verification of the qualitative data, which consists of checking or confirming the research processes “[...] to incrementally contribute to ensuring reliability and validity” (Morse et al., 2002), happened consistently during the research phase. During the interviews, the

participants were sometimes asked for confirmation on whether their statements or experiences were understood correctly. Additionally, the use of a recording device during interviews made the interview report more accurate than by note-taking (Opdenakker, 2006), and enabled the raw data to be revisited at any time during the analysis process. During the verification of the research, it was decided that the analysis and interpretation of the qualitative data gathered from the open-ended questions in the online questionnaire should be redone. This decision was made as it was discovered in the verification process that the analysis had not followed the proper approach to content analysis, and that the previous codes and categorisations would therefore prove challenging to reproduce and evaluate by other researchers. This iterative approach therefore assisted in increasing the credibility and reliability of the research. However, ensuring the reliability of qualitative observations is a difficult task, as the research takes place in natural settings where unique events can take place. These events are unlikely to be precisely reconstructed by other researchers and participants, and will therefore not yield identical results (LeCompte & Goetz, 1982).

There are improvements that could have been made to the reliability and validity of the research. If a data analysis software had been utilised to code the textual qualitative data, the reliability would have been higher as the classification rules adhered to by the program should produce reliable codes and allow for better reproducibility (Insch, Moore & Murphy, 1997). However, using data analysis software over hand-coding can reduce the researcher's 'closeness to data', where interesting subject matter in the data can be missed due to the large focus on counting occurrences (Bassett, 2004). For future work it would therefore be beneficial to work together and discuss with other researchers and interpreters in order to achieve higher reliability and credibility connected to the interpretation, coding, and categorisation of the qualitative data (Kvale, 2006).

4 Results

The results from the different research methods are presented in this chapter, starting with the results from the methods used in stage 1 and followed by the results from the methods used in stage 2. The results acquired from qualitative methods are presented by theme. The presented results are discussed in chapter 5 based on the research questions.

4.1 Presentation of the questionnaire results

4.1.1 The respondents' beliefs and use of games

The online questionnaire was answered by a total of 60 respondents, distributed over different age groups and genders (see Table 2).

Table 2. *Cross Tabulation of Number of Respondents across Gender and Age*

Gender	21 - 30	31 - 40	41 - 50	51 - 60	> 60	Total
Male	1	9	8	5	3	26
Female	3	11	12	4	3	33
Wished to not share				1		1

Of the total respondents (n = 60), 75% stated that they play games in their spare time, where 40% of those who play are female. The majority of the respondents reported that they believe that games can have a positive effect on motivation and learning (see Figure 6).

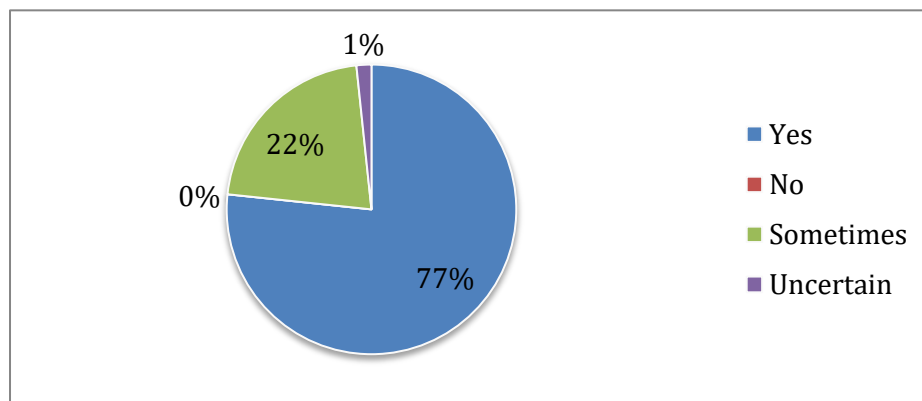


Figure 6. *Can games have a positive effect on motivation and learning?*

When asked to rate how beneficial using games in lessons is on a scale of 1 – 5 (1 = not beneficial, 5 = very beneficial), the respondents' answers (n = 60) yielded the arithmetic mean of 3. 56 out of 60 respondents reported that they are using games in their own lessons. 3 out of the 4 respondents who do not use games in their lessons additionally reported that they do not play games in their spare time either. The reported frequency of the use of games in lessons is varied. 3 out of 56 respondents reported using games in lessons every day, while 9 reported using games a few times a week. 23 of the respondents reported using games a few times a month, and the remaining 21 reported using games a few times a year.

The respondents (n = 60) were asked through an open-ended question what a game needs to contain in order to be a good teaching tool. The majority of the respondents answered that a game needs to contain educational content, as well as elements that can motivate and engage the players (see Figure 7). However, there were many who responded with broad statements such as “the game should be fun to play”, “be motivating”, or “it should be educational” without offering further insight or specifications on what elements in games can promote player motivation and learning.

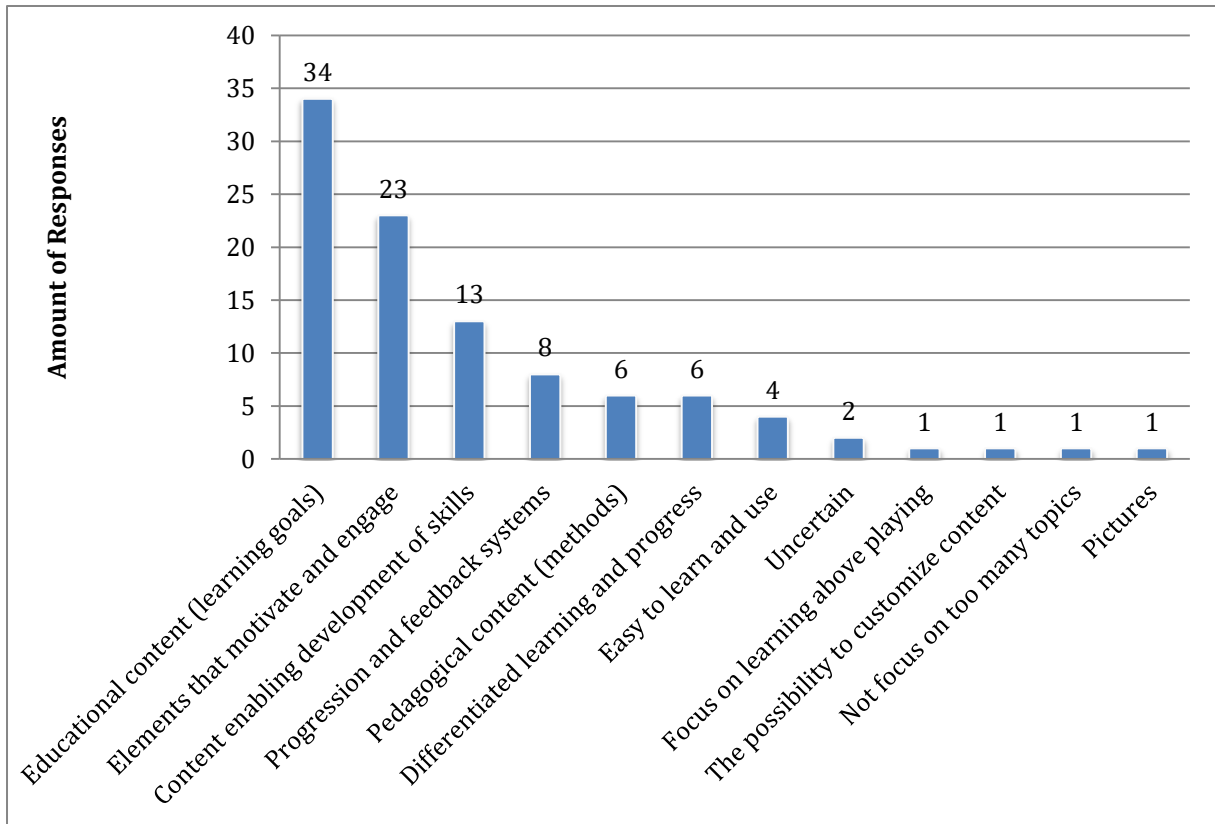


Figure 7. What does a game need to contain to be a good teaching tool?

The respondents who use games in their own lessons (n = 56) reported that they choose to utilise them for different purposes (see Figure 8). These findings indicate that the primary use of games in education is for learning purposes connected to subject matter and the development of skills. However, games are also used for motivational purposes, where the games can serve as a break or as a reward for the students.

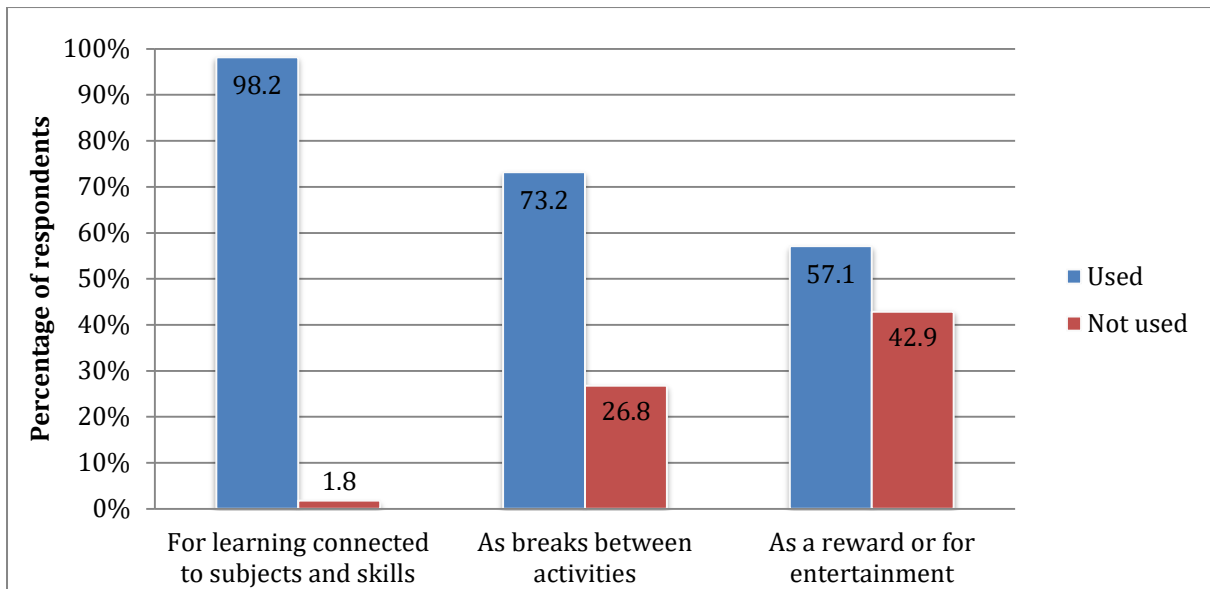


Figure 8. *What the Respondents Use Games for in Lessons*

The respondents who utilise games in lessons (n = 56) reported using different types of games (see Figure 9). The majority of the respondents have implemented digital games, dice games, board games and card games in their lessons.

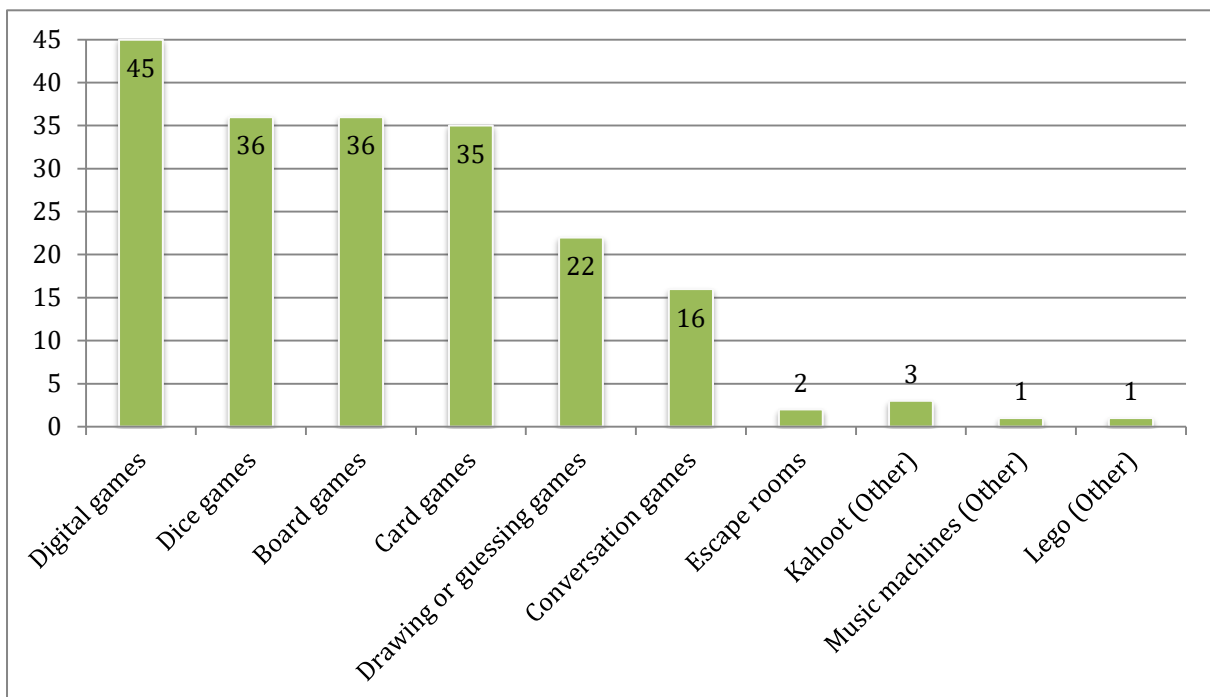


Figure 9. *Types of Games Used in Lessons*

The respondents (n = 56) were asked to rate on a scale of 1 – 5 how easy games are to use in lessons (1 = very hard, 5 = very easy). The rating resulted in the arithmetic mean of 3.77. The mean perceived ease of use among the respondents who teach in the lower and upper part of elementary school is 4.17 and 4.18 respectively. The mean perceived ease of use in lower secondary education is 3.62, whereas in upper secondary education it further drops to 3.43. Games are reported to be used more frequently in elementary school than in lower secondary school and upper secondary school (see Table 3). While there were 60 respondents in the

survey, 10 of the respondents reported teaching in multiple grade levels, which resulted in a higher total number of answers used in calculating both ease of use and frequency of use across grades.

Table 3. *Cross Tabulation of Grades Taught and Frequency of Game Use in Lessons*

Grades	Never	Yearly	Monthly	Weekly	Daily
Grades 1 – 4 (lower part of elementary school)	1	0	5	5	2
Grades 5 – 7 (upper part of elementary school)	1	2	7	6	2
Grades 8 – 10 (lower secondary education)	1	5	8	0	0
Grades 11 – 13 (upper secondary education)	2	15	8	0	0

4.1.2 Challenges of using games in lessons

The respondents (n = 60) were asked to note on their perceived or experienced challenges of using games in lessons twice, first through an open-ended question and thereafter through a multiple choice question (see Figure 10 and 11 respectively).

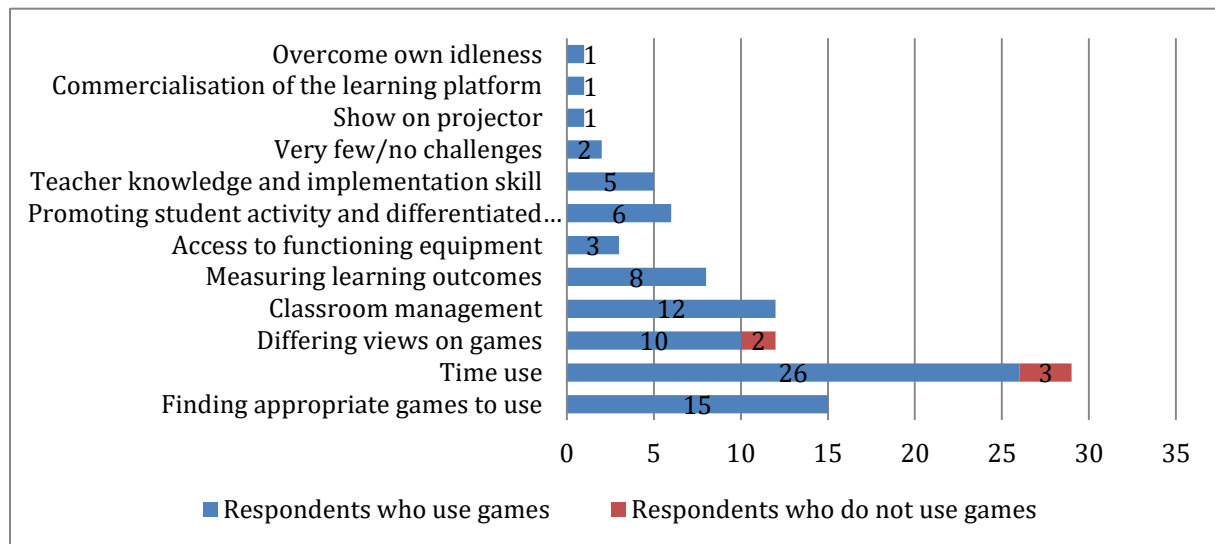


Figure 10. *The Experienced or Perceived challenges of Using Games in Lessons (Emergent Categories)*

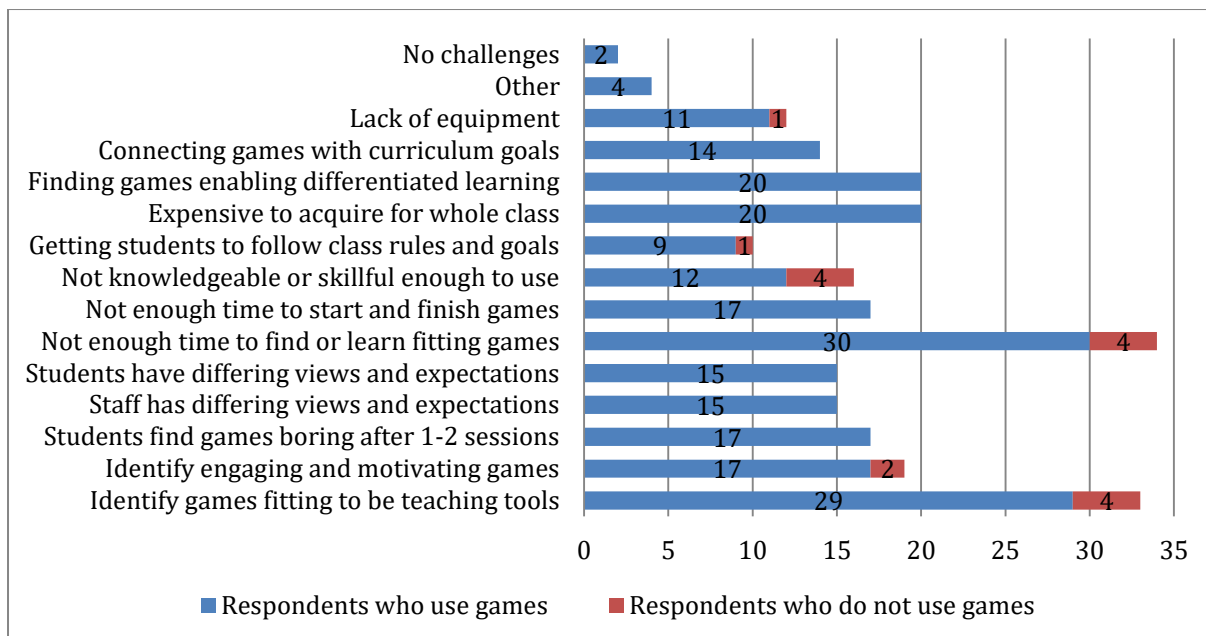


Figure 11. *The Experienced or Perceived Challenges of Using Games in Lessons (Predetermined Categories)*

The responses reveal that there are multiple experienced or perceived challenges of utilizing games in lessons. The predominant challenge is connected to games being time-consuming to find, learn and use, followed by difficulties in finding and identifying games that can be motivationally and educationally suitable to use in lessons. More responses were given by the majority of the respondents when provided with predetermined categories. Only 5 respondents noted upon the importance of the teacher’s knowledge and implementation skills for successful game use when providing their own answers, where 3 out of the 5 respondents expressed their own lack of knowledge about games. However, 16 respondents shared that one of the experienced challenges is that they do not feel knowledgeable or skilful enough regarding the use of games as teaching tools when provided with predetermined categories.

The four respondents who reported that they never use games in lessons all shared specific perceived challenges, such as lack of personal knowledge and skill, lack of time, and difficulties in finding games suitable to be used as teaching tools. The respondents (n = 4) were asked to provide comments on their reasons for not using games in lessons, and what would be required for them to start doing so. The responses called for more knowledge about beneficial game use, access to good educational games, and a larger focus on the educational content in games than on entertainment. Different views and expectations of games, such as the lack of focus on the educational content, were also viewed as a prominent challenge by some respondents who use games in lessons. There were concerns that students do not view games as educational and instead go into what a respondent called “game modus”, where students may view playing games only as an entertaining spare time activity.

4.1.3 The potential usefulness of supplementary resources

The respondents (n = 60) were asked to rate how helpful different digital resources connected to games can be for them as teachers. All of the resources were perceived to be useful to differing degrees (see Figure 12).

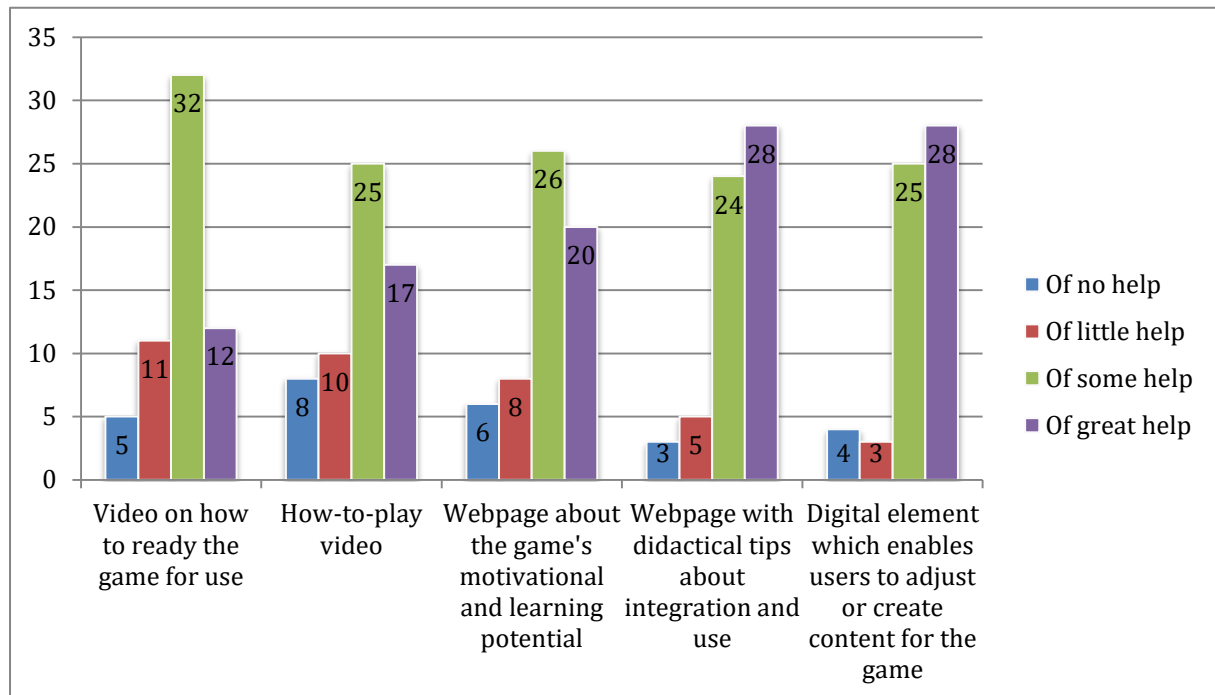


Figure 12. *The Perceived Usefulness of Different Digital Supplementary Resources*

Access to information about the motivational- and learning potential of the game yielded the mean score of 3 (1 = of no help, 4 = of great help). The suggested video resources were perceived to be the least useful ($\bar{x} = 2.85$), while access to didactical tips about use and the possibility to create or adjust game content were both deemed the most useful ($\bar{x} = 3.28$). The respondents were able to provide their own suggestions to helpful supplementary resources for teachers regarding the use of games as teaching tools. The suggestions called for non-digital resources such as resource personnel, face-to-face courses and observations, as well as access to “blank” analogue games which enable teachers to fill in their own content and activities. The suggestions also called for easier digital access to games, including trial subscriptions, county licenses, and access through apps or collective resource websites such as NDLA, the Norwegian Digital Learning Arena. Additionally, a respondent highlighted the need for the possibility to track the students’ in-game progress in real time via digital and online means.

4.2 Results from interviews, stage 1

Four teachers participated in the semi-structured interviews, consisting of two males and two females of different ages and work experience within the profession. The first participant is a 64-year-old male, who has worked as a teacher for 23 years and as a principal for 15 years. The second participant is a 30-year-old male, who has worked in the profession for 4 years. The third participant is a 27-year-old female, who has also worked as a teacher for 4 years. The fourth participant is a 52-year-old female, who has worked as a teacher for 20 years. The interviews were executed in Norwegian; however the quotations utilised in this chapter have been translated to English.

4.2.1 Games can be motivating and engaging to play

All 4 of the teachers participating in the interviews expressed that games can be motivating and engaging to play, primarily because games are considered fun, interesting, or exciting to play. Games are perceived to be able to promote competition or cooperation between the players, and that “when a game is competition oriented, it has a very good effect on many students” (teacher, 30, male). Half of the respondents view the fun aspect of games to result from mastery satisfaction. One teacher responded that she has “experienced that mastery and joy are very connected. So when they (the students) understand that these are rules that I understand and can master, then it becomes fun” (teacher, 52, female). Another teacher stated that:

Games can participate in creating a feeling of mastery and the experience of learning by one being able to solve problems and challenges in the game. This can enable one to experience learning as something fun and experience mastery in the subject (teacher, 64, male).

However, it was also commented upon that in order for the challenges in games to be motivating and yield mastery satisfaction, they have to fit the skill level of the players. If the challenges do not fit the skill level, then “the students who struggle or are not capable, [...] feel that it is incredibly boring” (teacher, 52, female). The same teacher also mentioned that games are played of one’s own volition, and need to be fun in order to be effective because “if it’s not fun, then I don’t think you learn anything from it” (teacher, 52, female).

4.2.2 Games can be valuable teaching tools and are utilised in classrooms

Games are perceived to be valuable teaching tools, but all of the teachers stressed that it is necessary for games to contain educational content connected to the subject being taught if they are to be used as teaching tools in the classroom. It was commented that “if one can manage to develop games that are in a way both pedagogically and educationally justifiable, then games can be a very pedagogical tool” (teacher, 30, male). However, the majority of the teachers mentioned that it can be challenging to find games with educational content: “I experienced that it was hard to find appropriate games to use, as few games are tailored for

use in education” (teacher, 67, male). He additionally noted that he therefore chose to develop his own games for use in lessons.

The majority of the teachers express that games are valuable tools as they can assist students’ skill development. Games can be used to help students “use and develop different skills” (teacher, 67, male), acquire “an understanding of numbers and practice motor skills” (teacher, 27, female), and “practice reading skills” (teacher, 52, female). It was also mentioned that students are active and deep learners while playing games because “they are allowed to talk and discuss with others, and [...] when you are active physically, then you are more active mentally too” (teacher, 52, female). She also expressed that the use of games in Mathematics, compared to reading in books, can “[...] provide a more effective learning, a deeper learning.” A teacher additionally mentioned that games promote opportunities for peer scaffolding, as “students of different academic levels in the same group [...] can help each other” (teacher, 67, male). All of the teachers reported having utilised games in their own lessons, but with varying purpose. Games have been used as a teaching tool, but also as a reward or a break between activities to promote motivation and engagement in lessons. One of the teachers stressed that the primary goal of a game used in lessons “[...] must be to learn something from it, if not there is not much use of it” (teacher, 30, male). However, he also expressed that “even if the educational content in the game isn’t always optimal, it can still have a positive effect after all, as one can spend some time on things that can give a little motivational boost.” The teachers reported having implemented games of different types, where the types of games that are used the most are board games, dice games and digital games. Two of the teachers reported using games in special education several times a week. The majority of the teachers voiced their use of games in Mathematics, as it is perceived that games can easily feature Mathematical content.

The teachers reported different personal interests in games and differing frequencies of game use in lessons. Half of the teachers described being personally fond of games and reported playing games almost every day. These participants also reported using games in their lessons up to several times a week. However, their weekly use was connected to special education, and they stated that games are used less frequently in ordinary classroom contexts. They expressed that “it is easier to implement games in special education with an individual student” (teacher, 67, male), and “[...] more challenging to make it work” in ordinary classroom education (teacher, 27, female). One teacher expressed having some interest in games, where there is one game he plays often. The teacher claimed to not be “[...] the most diligent user of games in lessons” (teacher, 30, male) and expressed that he uses games in his own lessons between 2 - 4 times a month. The last teacher reported playing hardly anything in her spare time, while also stating that she uses games “way too little” in lessons because she perceives it to be “[...] time-consuming and demanding” (teacher, 52, female).

4.2.3 Promoting student activity and differentiated learning can be challenging

All of the teachers perceived promoting differentiated learning as challenging when using games: “[...] it’s not that easy to adjust games to multiple levels when more students are included” (teacher, 27, female), and that “it can be hard to adjust it to the class’ learning goals and to the different students. Teachers are required to offer differentiated learning, but that is easier said than done with so many students” (teacher, 67, male). Organizing good group compositions for use in games was also stated by a teacher as challenging regarding the promotion of student activity, since group sizes and compositions are viewed as “[...] important for how the students experienced and participated in the game” (teacher, 67, male).

4.2.4 Teachers’ confidence and feeling of control impacts game use

The teachers expressed that they and other teachers are more likely to use games as teaching tools if they consider the game as easy to learn and to implement in lessons. A teacher shared that he has “[...] observed as a principal that some teachers declined an offer to try out a game from NTNU”², where he added that it can be “experienced as scary and demanding to both learn and try complicated games” (teacher, 67, male). He additionally commented that “if the teacher feels unconfident in a tool or teaching material, then one would probably not try it in lessons.” The majority of the teachers feel that using games in lessons can challenge the teacher’s feeling of control in the classroom, as games can create a chaotic classroom environment. The chaotic classroom environment was indicated to be experienced as negative, and could be connected to high noise levels, sabotage from students, or the feeling of not being able to manage the different students in the classroom.

When you have 24 students and they are all sitting there with their own games, maybe 4 together, then it’s clear that when you are one teacher, [...] the logistics aren’t that easy. If no one knows the game either, then it often becomes chaotic because the children lose their patience, and then they start wandering around or shouting (teacher, 52, female).

She also expressed that teachers can get bad experiences when using games due to challenges connected to equipment and own skill:

Often when you find the computers, then there are always like 5-6 who cannot log in, and when you are not very good at computers yourself, then it takes time. An hour can pass and you sit and feel like you haven’t gotten anything done (teacher, 52, female).

All of the teachers view being able to create or customize game content as positive, as it enables teachers to control the content of the game. Customization of content makes it “[...] easier to adapt the content to competence aims” (teacher, 27, female). Another teacher shared:

² NTNU stands for Norges teknisk-naturvitenskapelige universitet, which translates to Norwegian University of Science and Technology.

I like to have full control of what we implement, because then I can tailor it. It can of course be very useful in some cases to go for something that's already made, but often I have the need to tailor it to the specific content we are working on then and there (teacher, 30, male).

4.2.5 Time-consumption and accessibility as barriers of use

The majority of the teachers reported time and accessibility as a critical and challenging factor when using games as teaching tools. They find it time-consuming to both find and learn appropriate games to use in lessons: "I have experienced, and observed others experience, having little time to learn new things and new teaching tools" (teacher, 67, male). Another teacher shared that she uses "[...] an insane amount of hours" when searching for games on the internet, because "there is an ocean (of information) [...] and you kind of need to test it out to see if there is quality there" (teacher, 52, female). A different teacher expressed that "we stick to the usual games that are easily accessible in the classroom or on the internet" (teacher, 27, female), and that "at the other school they did not have games as easily accessible, and then it seemed like they were being used less too." Half of the teachers additionally view organizing a play session within the time constraints of a school lesson as challenging: "One has to place the kids in groups, get them started, and then it is recess" (teacher, 52, female), and "it is therefore positive if it can fit into one lesson, so that there is a result" (teacher, 67, male).

4.2.6 The importance of measurable results

The majority of the teachers expressed that it is important that games used as teaching tools can produce measurable results: "one has to be able to produce a measurable result, preferably within the lesson or within short time. This result can be to reach the end-goal of the game, or complete something special etc." (teacher, 67, male). One of the teachers mentioned the importance of visualized progress in the game connected to the content, as it can enable the teacher to "see in what degree the student group has followed the content. And the students themselves get to see a picture of how much of the content they have grasped" (teacher, 30, male). The possibility to measure learning outcomes can also be viewed as important for justifying the teaching method, as "you cannot use too much time on things that are not educationally justifiable" (teacher, 30, male).

4.2.7 Differences in pedagogical beliefs and expectations

The majority of the teachers deem that there are differences in views regarding the learning potential of games, and that many individuals may look at games mostly as a form of entertainment: "[...] there is a lot of negative views on games, primarily from the older generation because they do not always have an understanding of what games are and what the learning effect can be" (teacher, 67, male). Another teacher shared that "[...] games aren't really made by pedagogues, [...] so it becomes more like play" (teacher, 52, female). Other teachers or the school administration can have different views on games, which can lead to

the feeling of having to justify one's own teaching methods or purchase inquiries: "some can think why use money on purchasing games, when there are questions connected to how good a teaching tool it is? Are games a sensible use of money?" (teacher, 67, male). One of the teachers shared that she believes the school system and culture have seen too little development regarding teaching practices.

There have been many new reforms, but we're still sitting in the same old school where everyone is at their own desks. And if you work a bit differently in your class, then quickly others can think 'ugh, that class...it is very unruly', even though maybe that's where most learning is happening and it's the best place to be (teacher, 52, female).

Half of the teachers noted that the teacher and students can have different experiences with games, which leads to different expectations regarding the use of games in class: "students are more used to being entertained due to easy access to media. Students can have more requirements to gaming now than before, (therefore) the teacher and students can have a different view on what games are" (teacher, 67, male). Another teacher expressed that there are now many children who come to school and have never played the "good old" analogue games she is used to, but she reflected that they "have probably played more on phones" (teacher, 52, female).

4.2.8 The potential impact of supplementary resources

All of the teachers expressed that supplementary resources connected to games can be useful for teachers. "It is very positive with additional resources, as it will remove entry barriers" (teacher, 67, male). The teachers agree that video resources can make the game easier and more practical to learn, both for the teacher and the students:

It is very positive with video that can show how the game works, so that it is easier to learn the game. Videos can also reduce the time teachers need to spend to learn it. This can enable teachers to feel more confident in using it in lessons, especially if it's a more advanced game (teacher, 67, male).

When you have a class of 25-30 students, then it can be challenging to explain (the game) to all students, or get all students to follow along at the same time. I therefore think a good instructional video could be very effective and practical (teacher, 30, male).

In addition to video resources, the teachers reported the potential usefulness of written digital resources: "digital resources can be good supporting tools when one wishes to read up on games as teaching tools" (teacher, 67, male), and they enable teachers to "[...] acquire new knowledge on their own" (teacher, 67, male). It was also viewed as positive for written resources to include information about competence aims that can be covered by the game, as "then it becomes easier to include it in own lessons, when it concretely says that it can cover the goals" (teacher, 27, female). Half of the teachers expressed their desire for a collective resource website featuring suggestions or links to appropriate games connected to different

subjects, as well as instructional plans and tips on how to implement the games in lessons. One of the teachers stated that easy access to such a resource “[...] would facilitate more use of games in lessons” (teacher, 30, male). One teacher additionally conveyed his wish for access to available resource personnel:

It could be very positive to have resource personnel that are available to help with finding appropriate games, facilitate use, and provide tips regarding implementation. This has been common to have connected to ICT, but it can be very good to have connected to more specific teaching tools as well. This would be able to increase the use of games as a teaching tool, as teachers get direct help to acquire knowledge and skills connected to its use (teacher, 67, male).

4.2.9 The age of students can affect game use

Half of the teachers noted upon the benefits and challenges connected to using games with students of different ages. One teacher finds it easier to use games with younger students, due to lower requirements to the game content. She expressed that in order to utilise games in lessons with older students, “the games must contain much more, so they in a way get many challenges” (teacher, 52, female). She added that while she uses Ludo as a teaching tool with younger students, the game would have little to no learning effect on older students. However, a different teacher finds using games in lessons with students in upper secondary education to be the easiest:

I would be far more comfortable with and willing to try more advanced games in upper secondary, because then they are older and more mentally grown up. They would be capable of understanding and mastering those kinds of games. But it is also because it would be a much easier student group to handle discipline wise. It is not like it would be complete chaos in the lessons, like it can easily become in elementary and lower secondary education (teacher, 30, male).

4.2.10 Economic challenges

Half of the teachers also expressed that the school’s economy can prove a challenge regarding the use of games as a teaching tool, due to wanting to save on expenses: “The economy can be a problem, because I have experienced receiving a no from the principal to buy a classroom set of games” (teacher, 67, male), and “it’s always like that in a school, that one has to save money. One has to save money all the time” (teacher, 52, female).

4.3 Results from observations

The game Words of Power was implemented in a 5th grade classroom and in an 8th grade classroom. In the 8th grade class there were 23 students, while the 5th grade class only had 13 students, due to being split in two. In the results, the term “both teachers” refers to the teacher in 5th grade and the teacher in 8th grade.

4.3.1 The practical use of supplementary resources and advice

Both of the teachers that participated in implementing the game in their classrooms relied on the two created video resources when teaching the students how to set up the game components for play, as well as how to play it. The two videos were shown in front of the students using a smartboard in the classrooms. First, the teachers showed the video which explains how to prepare the game for play, followed by the video explaining the core rules of the game and how to play it. Both teachers chose to pause the videos at specific points, as advised about game integration in the classroom. The pauses were initiated in order to enable the students to imitate the actions showed in the video or to let the students play specific parts of the game before new rules were introduced.

During the first play session in 8th grade, the teacher chose to read up on additional game rules that are not explained and showed in the videos. He then connected his laptop to the classroom’s smartboard, enabling the students to view the additional rules. For the second play session in 8th grade, the teacher had printed out a sheet of paper containing specific rules in written form. Both the teacher in 5th grade and 8th grade chose to seek advice or information from the research conductor regarding the game during the play sessions while the students were actively playing. Their questions primarily concerned their understanding of the game and specific rules, as they sought confirmation that they had answered and guided the students correctly.

Both teachers chose to talk about the goal of the game and their expectations of the students before initiating the play sessions. The 8th grade teacher highlighted that it is important to show consideration of others’ knowledge and skills while playing the game. It was advised on the resource website that this is an area that should be talked about before playing, as there can be some content which can be experienced as easy by some students, while it can be challenging for others. Both teachers chose to set 2 - 4 tables together to form larger playing areas, and to pre-arrange the students into homogenous groups, which better enable peer support. These are both suggestions written on the resource website. In 8th grade, the teacher chose to not include a specific game component and content in the first play session, with the aim of making it easier for the students to learn how to play the game. This was also stated as an option on the website regarding methods on how to learn the game.

4.3.2 Perceived challenges during classroom use

Learning and using a new game was observed as time-consuming and at times demanding for both the teacher and the students, especially in 5th grade. While the 8th grade class consisted of a larger student group, it was observed as both quicker and less demanding to get the students started with playing the game. The students understood the rules quicker and needed less help and guidance both before and during play. The teacher in 5th grade was asked more questions both before and during play, which suggests that the students had a harder time learning how to play the game. The 5th grade teacher also experienced potential technical issues. At one point she accidentally restarted the video which required her to spend time and effort to recover where they left off. In the beginning of the first video, one student group also had to spend time to relocate in the classroom, as they were unable to see the screen properly.

In both 5th grade and 8th grade, the teachers had to correct unwanted student behaviour and focus on classroom management. In 8th grade, a student threw a game piece on the ground, which he was promptly asked to pick up again and to treat the game pieces in an appropriate manner. At the end of the second lesson, it was observed that the teacher in 8th grade had to spend time and effort to both gather and calm the students after playing, as the students believed they were done with the lesson after packing up the game. In 5th grade, the teacher used classroom management techniques to shift the students' attention to her whenever she deemed them to be too loud or had their focus elsewhere while they were preparing and learning the game. At one point the 5th grade teacher had to converse privately with a student, as he was causing disturbances with vocal and perceived inappropriate comments. She also faced challenges when students in each group sought help from her when they were ready to try to play their first turn in the game. The teacher was only capable of helping one group at a time, which caused a few individual students in other groups to become impatient and vocal about the waiting time. When the 5th grade teacher collectively addressed a specific question asked by a student, another student was talking at the same time. This caused the teacher to halt the focus on the game to talk about expected student behaviour in the classroom. During play in both 5th grade and 8th grade, the majority of students in different groups were perceived to show high engagement. The engagement resulted in communication between multiple players in each group, which when occurring at the same time could produce a high noise level in the classroom.

4.4 Results from interviews, stage 2

4.4.1 The experienced benefits of the digital supplementary resources

The teachers were asked if they would have used the game in their lessons without access to the provided supplementary resources. One responded a clear “no, I would not have done that” (teacher, 36, male). He expressed that the game is relatively complicated and that access to just a regular game manual would not be enough for him to be willing to utilise it as a teaching tool. He additionally stated that “I don’t have any background in roleplay and fantasy, so then it is extra challenging for me to use [the game] without many resources” (teacher, 36, male). The other teacher also responded that she would not have used the game without access to supplementary resources:

It has to do with what you are confident enough to use. There are many pieces revealed when you open the game box. I think I would have spent more time [on the game], and would maybe have thought that this is something I do not have time to look through, and would therefore have put it away. But when you have videos, then it is very easy. It is probably easier to start at something new when you have something to show you how (teacher, 46, female).

The teachers were of the opinion that the provided digital resources were explanatory and useful: “the videos and explanations were very thorough” (teacher, 36, male). “There was nothing that felt unusable” (teacher, 46, female). The information about the game’s design and educational purpose was experienced to be capable of assisting in justifying the choices you make as a teacher: “For example, if you get questions from parents about why you spend time on games, you have the answer” (teacher, 46, female). The videos were experienced as especially useful by one teacher: “I experienced that the videos were very good, which made it (the game) easy to use” (teacher, 46, female). She also expressed that videos are useful to teach the students, because “when they see it visually, it becomes easier for them to do the same actions.” Both teachers expressed that having access to similar digital resources about other games would be useful: “I think it would be very useful, [...] I enjoy trying new things” (teacher, 36, male). Also, “when you find web resources that are good, you add them as favourites, and that is something I would do with a page containing resources about the use of games” (teacher, 46, female). However, both teachers shared that they do not come across resources connected to games often. One of them believes there are generally few good educational games and good game resources: “But I do not think there are enough of either web resources or good games” (teacher, 46, female). She additionally explained that “[...] there has been an increasing focus on competence goals and learning goals, which can make you forget that you have other resources you can use. And I think the use of games has therefore become reduced.”

The teachers were asked if there are other digital resources than the ones provided that could be useful for the integration of games in classrooms. One of them expressed her desire for access to information about how the game Words of Power can be customized, as she believes “[...] that too would be highly beneficial to include in the web resource” (teacher, 46,

female). Additionally, she believes a website dedicated to “[...] inform about good games for use in education, maybe divided by subjects” can be of great use for teachers (teacher, 46, female). The teachers were additionally asked if the face-to-face meeting with the research conductor, prior to the classroom implementation and use, was experienced as useful and a deciding factor in whether they were willing to use the game in lessons. The face-to-face meeting was perceived to be a valuable resource primarily connected to their confidence, however they believe access to the provided digital resources would have been enough support for them to be willing to use the game: “if I just had access to the digital resources, it would probably still have been fine, but the meeting provided me with higher confidence” (teacher, 36, male). The other teacher expressed:

I would have managed just fine. The videos were so well made so they were very easy to understand. But it was also very OK with the talk beforehand, because then I knew better what I could expect. [...] I believe it is an advantage (to meet face-to-face), but I would have managed only with the web resources, only with the videos too (teacher, 46, female).

4.4.2 The perceived educational usefulness of the tested game

The teachers were asked if the game was experienced as educationally appropriate to use in their classes. Both teachers perceived the game to be engaging to play for students in both 5th grade and 8th grade; however the educational content was not deemed challenging enough for high competence students in 8th grade. The teacher expressed that he “[...] would have used the game system again”, but the game content would need to be adjusted to provide bigger educational challenges (teacher, 36, male). Additionally, it was perceived that the educational content in the game is not aligned with 8th grade curriculum and lesson goals. The teacher shared that a challenge with using games in 8th grade is forming a relevant and direct connection between “[...] what we are working on and what we will be working on” in the lessons (teacher, 36, male). While he expressed that the game content did not fit well to high competence students, he believes it would be beneficial to use with students who have lower competence in the subject.

The educational content in the game was perceived to be appropriate for use in 5th grade. The teacher expressed that the game enables differentiated learning, as there is “[...] a very good differentiation in the cards”, which enabled the students to choose the difficulty of the educational challenges (teacher, 46, female). The game balance between learning and fun was experienced as good, where the game provided a good method of practicing English spelling. The teacher stated that she would be willing to utilise the game again in 5th grade, “especially now that I know the game, and have seen that it is engaging” (teacher, 46, female). She additionally highlighted the game’s capability for being customized, where she expressed that the game system could be used to teach different content connected to the subject. Customized cards “[...] could be used to teach sentence structure, regarding how you form correct sentences and use the correct verbs, and to conjugate verbs and nouns” (teacher, 46, female).

5 Discussion

In this chapter the results of the study are discussed. The research question ‘what makes games beneficial teaching tools, and what is the perceived state of knowledge of teachers on this topic?’ is discussed first, then the research question ‘what perceived challenges hinder the adoption of games as a teaching tool?’ is examined, followed by the research question ‘does access to digital supplementary resources facilitate the use of games as teaching tools?’

5.1 What makes games beneficial teaching tools, and what is the perceived state of knowledge of teachers on this topic?

The discussion to this research question is divided into two parts, where one part discusses games’ capability to promote intrinsic motivation and learner engagement, while the other part discusses the capability to facilitate learning. Relevant theory connected to the topic is first discussed within each part, followed up by discussions on the respondents’ perceived state of knowledge on the topic.

5.1.1 The capability to promote intrinsic motivation and learner engagement

Intrinsic motivation and engagement are key aspects of effective learning, as students who are intrinsically motivated and engaged show more sustained interest, effective performance, and persistence while participating in learning activities (Deci & Ryan, 2008; Rigby & Ryan, 2011). Games promote intrinsically motivated behaviour by integrating elements and content which satisfy the players’ intrinsic psychological needs for autonomy, competence, and relatedness (Przybylski et al., 2010, Rigby & Ryan, 2011), as well as by offering opportunities to satisfy individual motivations for play (Yee, 2006a). Games of different types and genres integrate different elements and content, and therefore satisfy the players’ innate needs and interests to differing degrees. According to theory (Dickey, 2005; Rigby & Ryan, 2011), games are the most effective in nurturing intrinsic motivation and learner engagement when they:

- integrate varied situations where the players can make perceived meaningful choices and form different solutions;
- enable affiliation and social interactions between the players or between the player and non-playable characters (NPCs) in the game;
- provide the players with clear goals and challenges befitting their skill level to promote mastery satisfaction;
- provide rapid performance feedback on the players’ actions and behaviour;
- provide clear instructions and guidelines that assist the players in learning the game controls and how to participate in the in-game activities;
- enable the players to fail without adverse real-life consequences.

While not all games contain elements that can satisfy the innate need for relatedness by promoting affiliation and social interactions between players in-game, the context in which

games are being played can enable social interactions to take place. For example, in a classroom context all of the students are likely to be playing at the same time, and are therefore partaking in and experiencing many of the same activities side-by-side. While playing, the students can initiate face-to-face conversations with their peers, and the teacher can facilitate discussions around the game topics and the experiences of the students. Games can therefore be a tool that also enables social interactions and the formation of relationships to take place outside of the game, which participates in nurturing a beneficial learning environment that promotes intrinsic motivation and learner engagement.

The results of the research indicate that the majority of teachers view motivation as a potential positive effect of play, and that many teachers recognise the crucial role of intrinsic motivation in promoting beneficial learning environments. However, many of the teachers who responded to the questionnaire provided broad answers connected to motivation and engagement without specifying any elements that contribute to promoting intrinsic motivation and learner engagement. The teachers who were interviewed also provided broad statements that games generally contain elements that make them fun or exciting for individuals to play. These answers suggest that many teachers realise the importance of games featuring content that is deemed as interesting and motivating to the students as individuals, but that their knowledge of specific elements that can motivate and engage players is limited. As interview formats enable more in-depth and contextual exploration of topics, the majority of the teachers who were interviewed followed up on their initial statements about motivation. It was specified that games can be motivating and engaging due to games' capability of promoting competition and mastery satisfaction through the inclusion of challenges of appropriate difficulty. It is also possible that many of the questionnaire respondents have more knowledge on the topic than they were able to show, which could surface if they were prompted to provide additional explanations to their answers. However, fewer than 10 of the questionnaire respondents and only half of the interviewees remarked on the necessity of performance feedback in games. Performance feedback enables learners to identify the effects of their actions and adjust their actions accordingly, gain insight on how well they are performing in different situations, and gain information on their cumulative competence and how their abilities have developed throughout the game. Performance feedback is, according to theory, a crucial factor in promoting mastery satisfaction, engaged learning, and intrinsic motivation by recognising the learners' abilities, and should therefore be present in games to foster beneficial learning environments (Dickey, 2005; Rigby & Ryan, 2011).

5.1.2 The capability to facilitate learning

Games have the capability to foster beneficial learning environments through the inclusion of elements that promote intrinsic motivation and learner engagement (Dickey, 2005; Rigby & Ryan, 2009), and by incorporating content that facilitates various student-centred approaches to teaching and learning (Gee, 2007). Games can be viewed as networked spaces that are designed to enable and guide players of different abilities in acquiring the necessary knowledge and skills to overcome varied challenges of increasing difficulty. Games of different types and genres contain different game content, and can therefore provide the players with diverse methods of acquiring knowledge and skills. For example, in digital multiplayer games the players can seek out multiple sources of knowledge to assist in furthering their progress in game. The players can utilise the game's instructions and help manuals, ask for information and support from others, either in-game or outside of the game, seek out information from NPCs (AI agents) in the game, or acquire information about the game from other arenas, such as through written guides or videos on the internet that have been created by other players. Through playing games, students can practice and develop their abilities in filtering information and determining which connections or tools they can utilise to learn more, improve their performances, and progress in their endeavours.

Games can integrate educational content that can promote learning connected to specific subject or skills, and can facilitate different student-centred learning strategies, such as experiential learning and situated learning (De Freitas, 2006; Shaffer et al., 2005). Many games offer an experiential approach to learning, where the players' progress results from actively interacting with the game content, experiencing the effects of the interactions, reflecting on the outcome, then forming a hypothesis that can be tested anew in the game world (Gee, 2007). Games can in other words enable players to learn from exploring and interacting with the game environment and through social interactions with other players, propose different solutions to challenges, and through trial and error in safe environments. Additionally, game environments can promote situated learning. The activities in games tend to have direct connections to the environment in which the activities take place. This enables the players to actively participate in contexts where they can learn, demonstrate, and develop knowledge and skills that are relevant and useful in the situation (Van Eck, 2006). Different situations in games promote the acquisition of different knowledge and skills. The nature of the knowledge and skills the learners acquire is therefore directly connected to the integrated game content, which makes it crucial for teachers to assess the content and activities before using the games as teaching tools. Games can contain content that is directly connected to specific school subjects and curriculum goals, or content that requires the players to practice and develop different skills that are crucial for effective participation in our modern society.

Games that integrate student-centred approaches to learning can be effective tools in promoting deep learning and the development of 21st century skills (Gee, 2007; National Research Council, 2013). Games of different types and genres require the players to be creative problem solvers and innovators, effective communicators, critical thinkers, and team players. For example, the popular digital game Minecraft (which now also offers an education edition) promotes the players to collaborate in exploring the open world, overcome

challenges through utilising their abilities, and to be creative participants in collective building projects. Multiplayer games also promote the use and development of communication skills. Some games require the players to utilise written communication to cooperate or collaborate with others to overcome challenges and reach specific goals, while other games also enable the use of speech for more efficient communication. Additionally, many games require the players to be critical thinkers and problem solvers to progress, for example by solving puzzles and mysteries, creating and modifying strategies, or by engaging in conflicts where the players need to make ethical choices that impact the game world and story. Activities that promote the development of 21st century skills also promote deep learning as the players are actively engaged and are using thinking processes that further their own understanding and skills (Entwistle, 2003; National Research Council, 2013). However, while students can acquire new experiences, skills, and situated knowledge in game environments, they may not be capable of identifying the potential use areas of the acquired knowledge and skills in non-game contexts (De Freitas & Oliver, 2006). It is therefore important that teachers are aware of this limitation and help facilitate transfer of learning by assisting the students in creating connections between the game content and real-life contexts. Game activities can for example be introduced and followed up with discussions, activities, and reflections related to the game, which assist the students in forming connections between their existing knowledge and the knowledge acquired in the game.

Games can also serve as good tools to promote student activity and differentiate student learning. For example, games can offer various difficulty levels connected to the content and challenges that each player can select, or games can utilise dynamic game balancing to ensure that the game content is always adjusted to each player's abilities. Digital games can additionally differentiate the scaffolding that is provided in real-time to each player. Digital games can for example provide the players with visual and auditory step-by-step instructions that assist them in learning how to play the game and complete specific actions, or provide activities where the players model the portrayed actions and behaviours to acquire new knowledge or skills. These instructions and activities are often directly connected to the skill level of the players, where players who are playing on a lower difficulty tend to be provided additional scaffolding. The scaffolding provided by games generally assists the players in learning the controls of the game, what actions can be performed in the game, how to perform the specific actions, as well as help the players understand and reach the goals in the game. However, the instructions in digital games are rarely provided all at the same time, which can be a common occurrence during classroom instruction, but are provided individually to each player when he or she reaches specific milestones. Another way that games can differentiate learning is through the inclusion of levels and challenges that serve as gateways to new content and higher difficulties. In games, the players typically need to successfully accomplish certain tasks in order to advance to the next level or challenge. The learners therefore progress at their own pace, as they are not pushed to advance to new content before they have an adequate understanding of the current content. The players' progression in games thus reflects the players' abilities. This enables games to be effective learning environments as the players advance based on their abilities, where performance feedback and scaffolding are provided based on the players' performed actions, and abilities. Both

digital and analogue games can provide beneficial learning environments; however there are limitations to how well analogue games can differentiate student learning due to being less capable of directly providing individual progression, feedback, and scaffolding.

In this study, the majority of the teachers emphasised that games need to contain content that aligns with specific subject content or curriculum goals to be beneficial teaching tools to utilise in classroom education. However, only a few noted on the need for games to integrate specific pedagogical approaches to learning in order to create effective learning environments. This indicates that the majority of teachers perceive the educational content in the game to be the most critical, while perhaps not considering how the content is delivered to the players. A possible explanation to why the learning approach in games is not as heavily considered as an important element may be due to common perceptions and attitudes towards games. Games are by many considered to be inherently entertaining and engaging to play, which may cause individuals to take for granted the integrated elements that make up the learning environment. If teachers select games to play primarily based on the inclusion of educational content, without taking into account the environment in which the content is presented, they risk implementing games that are less effective as a teaching tool. It is therefore important that teachers have sufficient knowledge, or access to networks where they can acquire the necessary knowledge, to make judgements on which games can be beneficial to use as teaching tools, and how to effectively implement them in classroom contexts to promote student learning.

5.2 What perceived challenges hinder the adoption of games as a teaching tool?

The results of the research reveal that games of different types, both analogue and digital, are used as teaching tools in Norwegian classrooms; however there is potential for increased usage. The results reveal that there are multiple perceived challenges of different nature that hinder the use of games as teaching tools in Norwegian classrooms. One of the predominant barriers hindering the adoption of games is perceived to be time use. The term time use is here connected to the time teachers need to spend to identify and acquire a game fitting to use in lessons, learn how to play it, plan its use, and implement it, in addition to the time the class collectively spends on playing the game. Many teachers experience having little time outside of their other responsibilities to learn new things, such as how to effectively use new teaching tools. Therefore, teachers seem more inclined to adopt tools that require little time and effort to find, learn, and implement. Many teachers also prefer the students to be able to finish activities or meet specific goals within each lesson, where one lesson typically lasts 45 or 60 minutes. Time restrictions in lessons can therefore hinder the use of more complex and lengthy games. Games that are perceived as easy to access, learn, play, and finish are therefore more likely to be implemented as a teaching tool in classroom contexts.

Identifying and acquiring appropriate games to utilise as teaching tools is viewed as another predominant challenge. This can be a challenge due to different reasons. First, teachers need to rely on their own knowledge, or the knowledge of networks, to identify games that can be

beneficial teaching tools. If their own knowledge connected to games is lacking and they do not know which networks to utilise to acquire the necessary knowledge, then identifying and acquiring appropriate games for classroom use become tough and time-consuming tasks. Second, the school's economy and equipment need to be taken into account in the search for games to utilise as teaching tools. Most modern games of high quality production are expensive to purchase, especially when a whole classroom set is needed. Modern digital games additionally require the school to have access to different equipment, such as up-to-date computers for each student in the classroom, computer mice and headsets, often in addition to stable internet access. Some teachers highlighted the lack of equipment at their school as a challenge, which suggests that some schools do not have the necessary equipment to enable teachers to pursue the use of certain digital games as teaching tools. Third, while there are many games developed each year, few of them may be beneficial to utilise as teaching tools to promote student learning in different subjects. The majority of teachers in the study reported that games need to contain educational content, preferably directly related to subject matter or specific learning goals, in order to be beneficial teaching tools. For teachers to use games as teaching tools, there therefore needs to be a market for educational games. There may not be many high quality games that contain content with direct connections to subject matter and state wide or local curriculum goals. The production of and access to games that can be perceived as appropriate to use in classroom contexts can therefore be a barrier to the use of games as teaching tools.

Many of the teachers who participated in the study revealed that their own knowledge connected to the effective use of games can participate in hindering the use of games as teaching tools in classroom contexts. The results suggest that if teachers are not confident in their own abilities or about the potential learning effectiveness of games as a teaching tool, then he or she is unlikely to utilise games in lessons. These perceptions align with theory on the impact of teachers' pedagogical beliefs and self-efficacy on the use of new teaching tools in classrooms (Ertmer, 2001; Ertmer, 2005). The results also reveal that there may be a connection between teachers' personal interest in and experience with games and their use of games as teaching tools in classroom contexts. A possible explanation to this connection lies within the concept of self-efficacy. Positive personal experiences can impact individuals' belief of personal mastery, which contributes to an increase in self-efficacy (Bandura, 1977; Ertmer, 2001). Teachers who do not have much personal experience with games may therefore be less confident in their own abilities to use them as teaching tools in lessons. Teachers' self-efficacy can therefore not only facilitate the use of games, but also hinder the adoption of games as teaching tools. The beliefs and attitudes of colleagues are also perceived by many teachers to be a challenge connected to the use of games in classroom education. This aligns with theory on the impact of school context, as school culture can influence teachers' pedagogical beliefs and teaching practices (Ertmer & Ottenbreit-Leftwich, 2010). Additionally, many teachers view the differing attitudes and expectations towards games from students as a challenge regarding the use of games in classrooms. The different expectations are perceived to result from differences in knowledge and experience between students and teachers, as the games students play in their spare time are commonly vastly different than the ones used in classrooms for educational purposes. Children and adults alike

may perceive games to primarily serve as entertainment, and may therefore have misplaced expectations when games are used in classroom contexts. A few teachers feel that the different expectations and attitudes towards games risk making games less beneficial as teaching tools, as the students predominantly play to be entertained. The students in classroom education also contribute to another perceived challenge, which is classroom management.

Classroom management is perceived to be a challenge, especially when implementing new games the students are not familiar with and do not know how to play. Difficulties connected to classroom management can include high noise levels from high engagement, or the lack thereof, and the loss of patience while learning, which can cause the students to disturb the activity. There are also difficulties connected to logistics in classrooms consisting of many students. These difficulties require time to solve during lessons, which detracts from the time the students can spend on learning activities before the lesson is over. Many teachers therefore perceive it to be more challenging to use games as teaching tools in large classes. For example, teachers may not feel capable of managing and scaffolding all of the students while they are learning the game and while they are engaged in the game. It is also perceived to be challenging to enable differentiated learning in large classes. While games have the capability to offer effective methods for differentiating learning, not all games integrate these methods. If the implemented game does not offer differentiation, it is more challenging for the teacher to ensure that the activities in the game promote learning for students of different abilities and needs. Consequently, it is therefore perceived as easier to implement games in special education as there are fewer students, which makes it easier for the teacher to provide differentiation and scaffolding to each student. The results further indicate that teachers experience games to be easier to use in classrooms where the students require fewer educational challenges. It is perceived as more challenging to find games that are appropriate to use in classrooms with older students, due to higher requirements connected to gameplay, challenges, and the educational content. This may explain why teachers report utilising games more frequently in elementary school than in lower secondary school and upper secondary school. Teachers therefore need knowledge about, and access to games that align with specific curriculum goals and promote intrinsic motivation and learner engagement in order to increase the use of games as teaching tools in education.

5.3 Does access to digital supplementary resources facilitate the use of games as teaching tools?

Access to resources is an important factor in professional development to facilitate developments in teachers' pedagogical beliefs and classroom practices, as well as their self-efficacy (Lawless & Pellegrino, 2007; Scrimshaw, 2003). Resources can assist teachers in acquiring new knowledge connected to teaching tools and their potential effectiveness, as well as different methods connected to classroom integration. Digital resources can be particularly useful, as they are considered easy to access and enable teachers to acquire new knowledge unassisted, independent of location and time of day. Access to digital resources can therefore facilitate the use of games as teaching tools in classroom contexts by supporting professional development and lowering certain entry barriers.

Many teachers in this study perceive time use, their own knowledge and skills, and their ability to identify and acquire games to use as teaching tools to be among the challenges that hinder the adoption of games. Moreover, the teachers who reported never using games in their lessons all shared these perceptions. The results from both research stages in the study indicate that access to supplementary resources can ease these challenges in different ways, and therefore facilitate the use of games as teaching tools. For example, access to information about a game's potential to be a beneficial teaching tool enables teachers to acquire new knowledge on the topic. Knowledge about the potential effectiveness of games as a teaching tool can provide justification for teachers to implement the game as a tool in their teaching practices, in addition to making them equipped to justify their teaching methods to colleagues or parents who do not share the same pedagogical beliefs. Access to information about didactical implementation methods of games also enables teachers to acquire knowledge and guidance on the practical use of games in classrooms. This supplementary resource can further assist teachers in modifying their teaching practices and beliefs to facilitate the use of games to promote student learning. Access to videos showing and explaining how to prepare the game for use, as well as how to play, enables new methods of learning the game. Video resources are perceived to reduce the time and effort teachers are required to spend to learn how to set up and play the game. Additionally, the knowledge acquired through the videos can help develop teachers' belief in their own abilities connected to the game and how to introduce it in class. Access to videos can also assist teachers in the practical implementation of the game in classrooms, as the teacher can display the videos to the students to support them in learning the game. The opportunity to use videos as an instructional tool during lessons can further reduce the time teachers need to prepare for the instructions. Video resources can therefore participate in facilitating the use of games as teaching tools by lowering entry barriers connected to time and self-efficacy. Other digital resources that were perceived to be helpful for teachers include collective resource websites and resources that assist teachers in customising the game content. Collective resource websites connected to games can help teachers identify and acquire new games that can be beneficial to use in specific subjects. Some teachers state that access to such websites will facilitate an increased use of games in classroom education due to reducing the time they need to search for games,

and lowering the difficulty of the search and acquisition of games. Resources that assist teachers in customising game content are perceived to be useful due to providing teachers more opportunities for control over the game content. This control enables teachers to modify the learning activities in the game to provide the students practice in specific subject content. Resources that provide teachers with advice on customisation or enable them to modify or create content can therefore facilitate the use of games by providing teachers with knowledge and possibilities to provide students with challenges that are tailored to their abilities and specific subject content.

The teachers who participated in the classroom implementation of the game Words of Power chose to utilise the provided digital resources both during the planning stage and in the practical implementation of the game. They responded that they would not have been willing to use the game as a teaching tool if they did not have access to the digital supplementary resources, due to the perceived complexity of the game. Access to supplementary resources is therefore considered to be particularly important regarding the facilitation of games that are complex and unfamiliar to the teacher, as games that are perceived as challenging to learn and implement are unlikely to be integrated in classroom education. This further supports that access to digital supplementary resources can facilitate the use of games as teaching tools.

6 Conclusion

The purpose of this research was to provide insight on the use of game-based learning in Norwegian classrooms, the perceived challenges teachers face connected to game use, as well as the potential of digital supplementary resources to facilitate the use of games as teaching tools. The research shows that game-based learning is utilised in Norwegian classrooms to some degree, but that there are multiple perceived challenges that hinder teachers' adoption of games as teaching tools. Many teachers need to become more knowledgeable about how games as a medium can facilitate effective learning environments. Knowledge about what content and elements games need to contain to be beneficial teaching tools will assist teachers in identifying and acquiring games that can promote student learning in classroom contexts. Access to digital resources concerning game-based learning can support teachers in their acquisition of knowledge about games as teaching tools, assist them in locating and learning new games, and facilitate beneficial classroom implementation. Digital resources can promote professional development and thereby facilitate the use of games as teaching tools in Norwegian classrooms. However, there are external requirements that need to be met to facilitate game-based learning. Game developers need to develop high quality games that are designed to incorporate content and elements that promote learning, preferably with direct connections to specific subjects or curriculum goals. These games need to be easily accessible by teachers in terms of price and equipment, as well as the time it takes for teachers and students to both learn and play the game. If game developers or publishers want to expand their business into the education sector, they should provide supplementary resources that convey the potential efficacy of the game, guide the users in learning the game, and equip teachers with knowledge and strategies regarding effective implementation. To further facilitate the use of games in classrooms, game developers should seek to provide teachers with the capability to customise the game content, so they can tailor the content to specific learning goals.

6.1 Future research

Due to the limitations of the study, future research should seek to investigate the long-term effects of access to supplementary resources on game-based learning in Norwegian classrooms. Furthermore, research should be conducted to evaluate whether the findings of this study converge with the use of games in higher education and the perceived challenges professors face when utilising game-based teaching methods. An interesting avenue for future research could focus on how game-based learning in Norwegian classrooms is perceived by students. This research should concern whether the perceptions of teachers and students converge on how frequent game-based learning is utilised in classroom contexts or how effective the approach to teaching and learning is perceived to be. Another route for future research should focus on the availability of well-made educational games and which school subjects they can be used in as teaching tools. The research could reveal subjects or specific curriculum goals that cannot be covered by game-based learning due to a shortage of suitable games. The resulting knowledge can be utilised by game designers to create games targeting

areas of need, which can further facilitate the use of game-based learning in Norwegian classrooms.

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List of appendices

The data gathering was conducted in Norwegian, while the analysis of the data was conducted in English. The content in some of the appendices is therefore in Norwegian, while the content in others is in English.

Appendix A: Link to the website containing the developed supplementary resources

Appendix B: Online questionnaire questions

Appendix C: Interview guide 1

Appendix D: Interview guide 2

Appendix E: Online questionnaire raw data and quantitative results

Appendix F: Online questionnaire qualitative results

Appendix G: Interviews stage 1 data documents

Appendix H: Interviews stage 1 analysis

Appendix I: Observation data documents

Appendix J: Interviews stage 2 data documents

Appendix K: Observation and interviews stage 2 analysis